THE IRON TRADE REVIEW

VOLUME XXV. CLEVELAND, O., JANUARY 28, 1892. NUMBER 4.

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS
IS PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
27, 29 and 31 *Vincent Street, Cleveland, Ohio.*

TERMS, (strictly in advance):

One year	$3 00
Six months	1 50
Three months	75

Advertising Rates Furnished on Application.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

CLEVELAND, O., JANUARY 28, 1892.

THE WEEK IN IRON CIRCLES.

General Features.

In the absence of striking features in the iron market, it may be well to consider, for a moment, the causes of the present favorable condition of finances. These may be grouped under three heads: (1) the vast extent, the boundless resources, and the growing productive power of our industrial system, the condition of public and private credit, the rapid creation of wealth, the abundant surplus of our crops, present and prospective, with the eager and urgent need of them abroad, the unprecedented European demand for our best securities, and the prestige resulting from the prompt export of $70,000,000 of our gold reserve to meet the temporary crisis growing out of the recent panic in London; (2) the present conservative and business-like management of our national finances, and (3) the growing influx of new domestic and foreign capital. On the whole, the outlook could scarcely be better, and the *American Banker* expresses the belief, in view of the foregoing, that our aggregate exports of wheat and flour for the present fiscal year will far exceed those recorded for many years past, and many reach 200,000,000 bushels, adding by their value $290,000,000 to our national wealth and foreign commerce. The situation in our Central Western iron markets the past week is summarized below: With one or two exceptional trades, the same moderate business is being transacted at Detroit, at unchanged figures. Small orders are more frequent than for some time past, indicating increased activity among the smaller foundrymen, and as these have come from various points in the State, trade may be reported as generally better, and every indication of this nature, however small, causes a more hopeful feeling among the furnacemen. The buyers, too, are becoming more and more convinced each week that higher figures must soon be seen, and in consequence some inquiries for a considerable quantity of grey iron exists, which it is expected will be satisfied during the coming week. While these inquiries are largely for Southern iron, a considerable portion of Ohio softeners, and also foundry iron, will probably be bought. The exceptions noted refer to two round lots of Lake Superior charcoal metal which were purchased by car wheel men at the ruling prices and for reasonably quick delivery. As the month progresses, business at Chicago is keeping at about the usual volume for this period of the year; there has been considerable activity in coke irons, especially among Northern brands. Competition among makers of this class of metal is very strong, each contract of size is being vigorously contested and in many cases concessions have been made for desirable business. On Southern cokes a number of consumers are in the market inquiring for deliveries during the entire year of 1892; difficulty is being encountered in finding furnaces willing to make current figures to run over so long a period. Sales of Southern coke are for the most part being restricted to July or August as limit. Transactions at Cincinnati closed during the last week, have been for deliveries running six or eight months ahead and at current prices. The inquiry has been lighter than a week ago, and the whole temper of the trade is summed up in the word "hesitation." At St. Louis there has been a fair number of orders placed, and inquiry for prices continue to come in. The outlook for a large business this year is very good. We hear of sales of Southern No. 2 soft, on basis of $10 Birmingham, and some parties claim to have bought for less. Grey forge is being offerered in round lots at $9.75 cash Birmingham, for prompt shipment. A continued improvement in demand is noted at Buffalo the past week, without any noticeable change in prices. Locally the demand is of the hand-to-mouth character. There was a fair inquiry at Louisville during the past week, but no large sales have been recorded. A few transactions have taken place for amounts up to 500 tons, but generally sales have run in smaller quantities. Prices have continued to rule about the same.

Iron Ore.

Notwithstanding the large ore sales reported last week, and the inference then drawn that others would speedily follow, there has been a dearth of news in the ore market, and the dealers report no individual sales beyond those already quoted. It may be that the very sales already made have deterred the furnacemen from hurrying into the market. It may be remembered that since the close of navigation the ore men have been talking of an advance of from seventy-five cents to a dollar and a quarter a ton, while the sales, when made, showed but an average gain of thirty-five cents a ton, barely covering the increase in the cost of lake transportation, so that the price at the mine may be said to remain practically the same as last year. There has been no dearth of orders by consumers of iron, and large orders at that, but, strange to say, the market has not responded with any degree of confidence, and the advance in the price of pig iron, reported at the beginning of December, has been lost during the past week or two. Hence the hesitancy on the part of furnacemen is explicable upon good and substantial reasons. They argue that if iron ore is not appreciably dearer this year than it was last, and that, if despite the immense railway orders placed, the market for Bessemer iron and its principal products is as weak as ever, there is no hurry as to the purchase of '92 ore, and that it will befit them to work off a reasonable quantity of that which they now have on dock before incurring new obligations. On the other hand it is urged that the advance already referred to was not expected to be of a permanent kind, that no advance recorded on the eve of the holidays was ever known to last, and that the business, while dull, is no worse than is usually the case at this season of the year. The effect of the orders placed before the cold weather set in, will not be appreciable, it is claimed, before the middle of March, but that, thereafter, there will be a lively demand for Bessemer pig. It is also asserted in some quarters that some one in need of a large amount of Bessemer pig, may be purposely bearing the market so as to cover any shortage that may exist in that direction; and this view has been heard about the local market more than once during the past few days.

Pig Iron.

In the meantime, pig iron is very weak, and the stocks are rapidly climbing up to formidable proportions. Fifteen dollars, cash, at the majority of valley furnaces, is about the price of Bessemer pig; but even this price has been known to be high in some instances, and there is no end of shading quotations to make a round sale.

Merchant Iron.

The mills are fully employed, but their products are in no better demand than those of the furnaces, and the price of merchant iron is hardly promising. The only product that seems to bear up, indifferent to the remainder of all its kindred manufactures, is shape iron, such as is in the combination; and it is well known that, although the advertised price is sixty-four dollars a ton, shapes can be bought for less money than the "official" price.

Hardware.

The hardware trade, which at other seasons enjoys a good deal of a boom, is very quiet at present, partly because of poor transportation facilities offered by the railways, and partly on account of the cold weather, which retards all building operations. Metals are weak.

NEW ENGLAND'S IRON INDUSTRY.

"The Iron and Steel Industries of the New England States" is the subject of a very interesting census bulletin, just issued, under the name of Dr. William M. Sweet. As often pointed out and explained in these columns, the iron smelting industry of New England has shown a decadence during the past ten years, owing to the natural shifting of iron centers; hence the showing for this branch of the iron industry will occasion no surprise.

In this connection the fact must be noted that the statistics presented are confined to the operations of establishments manufacturing from the ore, forges and bloomaries, rolling mills, and manufactures of crude materials for the foundry, machinists', and other industries.

In 1870 there were 48 iron and steel establishments in New England, with an invested capital of $5,909,000, which employed 3,815 hands, to whom $2,168,719 in wages were paid, and which consumed materials costing $7,338,150, producing manufactures valued at $10,824,603.

In 1880 the number of establishments had increased to 61, with an invested capital of $11,560,408, the workmen numbering 8,654, and receiving wages amounting to $3,357,911, the cost of materials being $9,518,570, and the value of products amounting to $14,558,627.

In 1890 the number of establishments had decreased to 35, but the total capital invested had increased to $13,415,450. The hands employed, excluding officers and clerks, numbered 6,645, receiving wages amounting to $3,224,318. The cost of materials consumed was $9,286,050, and the value of the products was $15,105,441.

It should be considered that the values reported for 1870, are expressed in a currency which was at a great discount in gold, and for this reason they should be reduced one-fifth for purposes of comparison with the gold values of succeeding census years.

The status of the New England iron industry is thus succinctly stated by Dr. Sweet:

The decline in the iron rolling mill industry of New England has been due chiefly to conditions peculiar to locality rather than to causes affecting the industry at large. The rapid growth of the iron and steel industry in other sections of the country, where pig iron and fuel can be obtained at much lower cost, has gradually narrowed the market of most of the New England iron mills to the limits of local demand, and even much of this trade has been absorbed by manufacturers in more favored localities. The natural resources that are required for the profitable operation of rolling mills and steel works are lacking in New England. There is no local supply of either fuel or pig iron. Although considerable pig iron is made in Massachusetts and Connecticut, the entire product is used for foundry purposes. The small quantity of pig iron that is consumed by the New England rolling mills and steel works is brought from other producing regions, and all the coal and coke is similarly obtained. At the present time scrap iron constitutes the chief dependence of the rolling mills of New England, and this is the only raw material of which there is a local supply, the railroads and diversified manufacturing industries furnishing it in considerable quantity.

The rapid progress that has been made in this country in the manufacture of steel, the cheapening of the product, and its consequent substitution for iron for many uses have been important factors in the decline of the iron rolling mill industry of New England. The conditions in New England being generally unfavorable for the economical manufacture of the crude forms of steel, most of the iron manufacturers have been reluctant to assume the risks attendant upon the establishment of steel plants in connection with their works to meet the increasing demand for this class of material, preferring to depend upon a supply of crude steel obtained from works more advantageously located in other sections of this country or from abroad. Apart from the natural disadvantages of location, many of the iron manufacturers of New England have not shown a disposition to accommodate themselves to changing conditions, and not a few of them have retired from business in preference to re-modeling their plants to meet modern requirements. The re rolling of imported Norway and Swedish iron was formerly an important branch of the iron industry of New England, but within the past decade it has dwindled to small proportions, owing chiefly to the substitution of steel for uses to which this class of iron was formerly applied.

Out of such very evident facts as these the Free Trade press have manufactured their arguments in favor of "free raw material." It is a fact, not a theory, however, that confronts us.

STOCKS OF UNSOLD PIG IRON.

By reference to the table on the opposite page it will be seen that the stocks of pig iron which were unsold in the hands of the maufacturers or their agents on December 31, 1891, and which were not intended to be used by the manufacturers, amounted to 596,333 gross tons, against 442,055 gross tons on June 30, 1891, and 608,921 gross tons on December 31, 1890. The above figures include a part of the stocks of pig iron held at the periods named in storage warrant yards, and which was under the control of the makers, the part not under their control, on the 31st of December last, amounting to 30,900 gross tons, which added to the 596,333 tons above mentioned, makes a total of 627,243 gross tons which were on the market at that date. On the 31st of December, 1890, the storage warrant yards held 52,900 gross tons of pig iron which were not under the control of the makers, making a total of 661,821 gross tons which were then on the market. The difference between the aggregate of unsold stocks at the close of 1890 and 1891, was only 34,588 gross tons.

As to the present situation the *Bulletin* of the American Iron and Steel Association says:

If the demand for pig iron for consumption were now exceptionally active and if prices were advancing the stocks held at the close of 1891 would not be excessive. It is for the producers themselves to decide whether these conditions exist. It will be remembered that at the close of 1890 and soon afterwards many furnaces were blown out because of the accumulation of unsold stocks, yet they did not then aggregate much more than the quantity with which we began the present year.

As both of the above "ifs" must be answered in the negative, so far as the present condition of the market is concerned, the conclusion is obvious.

OUR IRON AND STEEL OUTPUT IN 1891.

With its usual promptness, the American Iron and Steel Association gives to the public the statistics of iron and steel production in 1891 only twenty-three days after the close of the year. As will be seen by the elaborate table on the opposite page, the total production of pig iron in 1891 was 9,273,455 net tons of 2,000 pounds, or 8,279,870 gross tons of 2,240 pounds, against 9,202,703 gross tons in 1890—a decrease of 922,833 gross tons, or over 10 per cent. The decreased production may be said to have all occurred in the first half of 1891, as the production in the second half of 1891 was larger than in either half of 1890.

Our production of pig iron in the second half of 1891 was 269,573 gross tons larger than in the second half of 1890, which was the half year of largest production in our history prior to 1891. Our production in the second half of 1891 was at the rate of 9,823,526 gross tons per annum. It was larger than in any full year in our history down to and including 1885, and larger than Great Britain's production in any whole year down to and including 1867. Our production of pig iron in 1891 was about one million gross tons larger than that of Great Britain in the same year.

The shrinkage in production in 1891, as compared with 1890, was distributed among the different fuels used in our blast furnaces, and it was shared by most of the pig-iron-producing States in the North and West, most notably by Pennsylvania, which lost over half a million net tons, all in the first half of the year. But the Southern States lost in the aggregate less than 40,000 net tons, while many of them actually increased their production in 1891 over 1890.

The production of steel rails in 1891 was 1,366,259 net tons, or 1,219,874 gross tons, a decrease of 577,615 gross tons from the production of 1890. Of the output of 1891 Pennsylvania produced 946,-154 net tons.

GREAT Britain's production of pig iron in 1891 was very much smaller than in the previous year. The Cleveland ironmasters' return show a production of 2,622,000 tons, which is 224,000 tons reduction on 1890. There was an increased shipment of pig iron by 86,000 tons upon the year, the total delivery being 890,000 tons, which, however, does not come up to some previous years. Shipments of manufactured iron and steel were much smaller than for some years, being 381,000 tons, or 125,000 tons reduction upon 1890. The Scottish ironmasters report the total production last year at 674,425 tons, being a decrease of 123,908 tons. The consumption amounted to 394,580 tons, a decrease of 371,815; exports were 313,613 tons, a decrease of 140,720. Stocks amounted at the close of the year to 597,677 tons, showing a decrease of 33,668.

COMPARISONS are not necessarily odious, and are often instructive. Last year was hardly a good one for the iron trade in the United States, but a glance across the water shows that it was much worse in Great Britain. There is that much comfort in it, anyhow.

THE Free Trade parrot of the Philadelphia *Record* has tuned up once more, and the dismal cry of "Free Iron Ore" will probably be repeated with painful reiteration from now until the ides of March at least. Then it will change to something else.

THE value of our imports of iron and steel and manufactures thereof, for the eleven months ending November 30, 1891, was $27,-712,482, compared with $24,409,547 for the corresponding period of 1890.

ACCORDING to *Bradstreet's*, 139 railroad companies reported gross earnings in 1891 to the amount of $551,356,941, or 6.5 per cent. more than in the calendar year 1890.

PRODUCTION OF PIG IRON IN THE UNITED STATES IN 1890 AND 1891.

Statistics collected from the Manufacturers by the American Iron and Steel Association.

Production in 1891—9,273,455 Net Tons, or 8,279,870 Gross Tons. Unsold Stocks at Close of 1891—667,893 Net Tons, or 596,333 Gross Tons.

Production of All Kinds of Pig Iron.

TOTAL PRODUCTION OF PIG IRON.

States.	Blast Furnaces. In blast June 30, 1891.	Blast Furnaces. Dec. 31, 1891. In	Out	Total	Production. Tons of 2,000 lbs. (Includes spiegeleisen.) First half of 1891.	Second half of 1891.	Total for 1891.
Maine	.....	.....	1	1	.....	.....	.....
Massach'setts	2	2	2	4	4,406	5,663	10,069
Connecticut	3	5	4	9	11,125	13,303	24,428
New York	13	14	23	37	161,795	191,130	252,925
New Jersey	5	5	10	15	66,592	36,997	103,589
Pennsylvania	134	135	84	219	1,859,023	2,567,650	4,426,673
Maryland	4	4	9	13	49,902	88,214	138,206
Virginia	12	13	20	33	141,908	188,819	330,727
N. Carolina	1	1	.....	1	1,003	2,600	3,603
Georgia	2	3	3	6	20,401	35,440	55 841
Alabama	26	34	19	53	376,389	514,765	891,154
Texas	3	1	3	4	8,465	12,437	20,902
W. Virginia	2	3	1	4	20,977	75,660	96,637
Kentucky	3	4	6	10	18,779	31,446	50,225
Tennessee	10	14	5	19	145,066	181,681	326,747
Ohio	43	40	32	72	445,113	714,102	1,159,215
Indiana	1	1	1	2	5,449	3,208	8,657
Illinois	10	13	7	20	204,816	544,690	749,506
Michigan	11	10	13	23	113,376	125,346	238,722
Wisconsin	6	7	3	10	91,098	129,721	220,819
Minnesota	.....	1	.....	1	.....	1,373	1,373
Missouri	1	2	6	8	9,102	23,634	32,736
Colorado	1	.....	3	3	13,646	6,644	20,290
Oregon	1	1	.....	1	3,759	6,652	10,411
Washington	.....	.....	1	1	.....	.....	.....
Total, 1891	294	313	256	569	3,772,280	5,501,175	9,273,455
Total, 1890	339	311	251	562	5,107,775	5,199,253	10,307,028

PRODUCTION OF CHARCOAL PIG IRON.

Maine	.....	.....	1	1	.....	.....	.....
Massach'setts	2	2	2	4	4,406	5,663	10,069
Connecticut	3	5	4	9	11,125	13,303	24,428
New York	2	3	6	9	3,962	7,681	11,643
Pennsylvania	5	4	11	15	5,484	6,335	11,819
Maryland	2	1	7	8	5,192	5,170	10,362
Virginia	1	1	13	14	2,179	1,445	3,624
N. Carolina	.....	.....	.....	.....	19	504	523
Georgia	1	2	2	4	2,420	15,216	17,636
Alabama	6	9	6	15	37,280	50,064	87,344
Texas	3	1	3	4	8,465	12,437	20,902
Kentucky	1	1	2	3	1,371	2,424	3,795
Tennessee	2	4	2	6	21,414	29,829	51,243
Ohio	8	5	7	12	8,180	13,988	22,168
Michigan	11	10	13	23	113,376	125,346	238,722
Wisconsin	3	5	1	6	52 357	53,026	105,383
Missouri	1	1	2	3	9,102	7,026	16.128
Oregon	1	1	.....	1	3,759	6,652	10,411
Washington	.....	.....	1	1	.....	.....	.....
Total, 1891	52	55	83	138	290,091	356,109	646,200
Total, 1890	63	64	76	140	314,427	389,095	703,522

PRODUCTION OF BITUMINOUS COAL AND COKE PIG IRON.

New York	3	1	2	3	81,483	33,927	115,410
Pennsylvania	53	52	28	80	980,581	1,673,693	2,654,274
Maryland	2	3	2	5	44,800	83,044	127,844
Virginia	11	12	7	19	139.729	187,374	327,103
N. Carolina	1	1	.....	1	984	2,096	3,080
Georgia	1	1	1	2	17,981	20,224	38,205
Alabama	20	25	13	38	339.109	464,701	803,810
W. Virginia	2	3	1	4	20,977	75,660	96,637
Kentucky	2	3	4	7	17,408	29,022	46,430
Tennessee	8	10	3	13	123,652	151,852	275,504
Ohio	35	35	25	60	436.933	700,114	1,137,047
Indiana	1	1	1	2	5,449	3,208	8,657
Illinois	10	13	7	20	204,816	544.690	749,506
Wisconsin	3	2	2	4	38,741	76,695	115,436
Minnesota	.....	1	.....	1	.....	1,373	1,373
Missouri	.....	1	4	5	.....	16,608	16,608
Colorado	1	.....	3	3	13,646	6,644	20,290
Total, 1891	153	164	103	267	2,446,289	4,070,925	6,537,214
Total, 1870	165	150	106	256	3,566,153	3,588,572	7,154,725

PRODUCTION OF ANTHRACITE AND MIXED ANTHRACITE AND COKE PIG IRON.

New York	8	10	15	25	76,350	149,522	225,872
New Jersey	5	5	10	15	66,592	36,997	103,589
Pennsylvania	76	79	45	124	872,958	887,622	1,760,580
Total, 1891	89	94	70	164	1,015,900	1,074,141	2,090,041
Total, 1890	111	97	69	166	1,227,195	1,221,586	2,448,781

SPIEGELEISEN.—The quantity of spiegeleisen and ferromanganese made in the first half of 1891 was 49,887 net tons; in the second half, 93,211 tons; total, 143,098 tons. In 1890, 149,162 tons.

Unsold Stocks of All Kinds of Pig Iron held for Sale by the Makers or their Agents.

TOTAL STOCKS OF UNSOLD PIG IRON.

States.	Tons of 2,000 lbs. June 30, 1890.	Dec. 31, 1890.	June 30, 1891.	Dec. 31, 1891.
New England	15,344	11,572	16,230	17,672
New York	38,323	64,381	74,325	69,627
New Jersey	500	25,068	39,128	22,939
Pennsylvania	135,303	204,535	84,400	152,577
Maryland	1,880	1,637	3,292	3,915
Va., N. C., Ga. and Texas	19,149	28,707	40,733	82,558
Alabama	58,717	69,957	41,517	54,356
West Virginia	1,080	11,414	.....	3,800
Kentucky	8,176	9,413	7,838	8,987
Tennessee	11 089	28,142	21,528	14,774
Ohio	46,192	116,608	60,776	83,611
Michigan and Indiana	18,339	56,452	51,764	72,838
Illinois	.....	19,504	30,732	55,270
Wisconsin	14,424			
Missouri and Colorado	13,424	29,434	17,662	19,035
Pacific States	7,304	5,168	5,177	5,934
Total	389,244	681,992	495,102	667 893

STOCKS OF UNSOLD ANTHRACITE AND MIXED ANTHRACITE AND COKE PIG IRON.

New York	24,989	48,044	57,711	49,379
New Jersey	500	25,068	39,128	22,939
Pennsylvania	57,671	91,189	54,052	66,976
Total	83,160	164,301	150,891	139,294

STOCKS OF UNSOLD CHARCOAL PIG IRON.

New England	15,344	11,572	16,230	17,672
New York	12,313	11,855	11,989	14,818
Pennsylvania	7,057	10,382	8,842	7,976
Maryland	580	1,492	2,892	2,488
Va., N. C., Ga. and Texas	6,545	13,318	13,216	27,325
Alabama	8,664	19,943	20,596	29,316
Kentucky	1,673	2,054	9,545	9,717
Tennessee	9,640	15,485		
Ohio	2,540	7,770	8,520	15,524
Michigan	18,339	55,037	51,764	72,663
Wisconsin	8,082	14,936	26,596	27,409
Missouri	11,408	7,376	6,314	8,037
Pacific States	7,034	5,168	5,177	5,934
Total	109,489	176,388	186,681	238,879

STOCKS OF UNSOLD BITUMINOUS COAL AND COKE PIG IRON.

New York	1,021	4,482	4,625	5 430
Pennsylvania	70.575	102,964	21,506	77,625
Maryland	1,300	145	400	51,368
Virginia	8,223	7.821	22,335	
Alabama, Georgia, and N. C.	54,434	57,582	20,103	30,332
West Virginia	1,080	11,414	.....	3,800
Kentucky	6,503	7,359	6,498	14,044
Tennessee	1,449	12,657	13,323	
Ohio	43,652	108,838	52,256	68,087
Indiana and Michigan	.....	1,415	.....	175
Illinois and Wisconsin	6,342	4,568	5,136	27,861
Missouri and Colorado	2,016	22,058	11,348	10,998
Total	196,595	341,303	157,530	289,720

STOCKS ACCORDING TO FUEL USED.

Bituminous	196,595	343,303	157,530	289,720
Anthracite	83,160	164,301	150,891	139,294
Charcoal	109,489	176,388	186,681	238,879
Total	389,244	681,992	495,102	667,893

STOCKS OF PIG IRON IN PENNSYLVANIA AND OHIO.

Pennsylvania.	Lehigh Valley	11,456	39,304	10,321	30,906
	Schuylkill Valley	20,001	27,190	24.703	18,340
	Upper Susquehanna V	9,338	7,472	6,453	4,066
	Lower Susquehanna V	15,452	16,733	10,075	12,024
	Juniata Valley	11,923	17,836	8,528	13,907
	Shenango Valley	13,490	42,272	3,706	25,158
	Allegheny County	19,900	14,880	895	20.261
	Miscellaneous coke	26,686	28,466	10,877	19,939
	Charcoal	7,057	10,382	8,842	7,976
Ohio.	Hanging Rock bitum	7,208	11,153	31.364	25,755
	Mahoning Valley "	17.074	52,632	6,310	28,330
	Hocking Valley "	13.012	16,391	6,713	9,373
	Miscellaneous "	6,3.8	28,662	7,869	4,629
	Hanging Rock charcol	2,540	7,770	8,520	15,524

NOTE.—The American Pig Iron Storage Warrant Company held in its yards on December 31, 1891, 51,900 gross tons of pig iron, of which 21,000 tons are included in the above tables as being still controlled by the makers, leaving 30,900 gross tons, or 34,608 net tons, of pig iron in other hands, much the larger part being Alabama iron.

Miscellaneous Pig Iron Statistics.

PRODUCTION OF PIG IRON IN 1888, 1889, 1890, AND 1891.

States.	Tons of 2,000 lbs. 1888.	1889.	1890.	1891.
Maine	5,574	5,200	1,200	.....
Massachusetts	13,248	7,751	5,531	10,069
Connecticut	21,644	24,143	22,552	24,428
New York	257,180	297,247	369,381	352,925
New Jersey	101,882	125,693	177,788	103,589
Pennsylvania	3,589,186	4,181,242	4,945,169	4,426,673
Maryland	17,606	33,847	165,559	138,206
Virginia	197,396	251,356	327,912	330,727
North Carolina	2,400	2,898	3,181	3,603
Georgia	39,397	27,559	32,687	55,841
Alabama	449,492	791,425	914,940	891,154
Texas	6,587	4,544	10,865	20,902
West Virginia	95,259	117,900	144,970	96,637
Kentucky	56,970	42,518	53,604	50,225
Tennessee	267,931	294,655	299,741	326,747
Ohio	1,103,818	1,215,572	1,389,170	1,159,215
Indiana	15,260	9,839	16,398	8,657
Illinois	579,307	601,035	785,239	749,506
Michigan	213,251	214,356	258,461	238,722
Wisconsin	116,037	158,634	246,237	220,819
Missouri	91,783	86,190	100,550	32,736
Minnesota	.....	.....	.....	1,373
Colorado	20,877	2,678	23,588	20,290
Oregon	2,509	9,426	12,305	10,411
Washington	4,093	10,371	.....	.....
Total	7,268,507	8,516,079	10,307,028	9,273,455

PRODUCTION IN 1891 ACCORDING TO FUEL USED.

Fuel used.	Blast Furnaces. In blast June 30, 1891.	Dec. 31, 1891. In	Out	Total	Production. Tons of 2,000 lbs. (Includes spiegeleisen.) First half of 1891.	Second half of 1891.	Total for 1891.
Anthracite	89	94	70	164	1,015,900	1,074,141	2,090,041
Charcoal	52	55	83	138	290,091	356,109	646,200
Bituminous	153	164	103	267	2,466,289	4,070,925	6,537,214
Total	294	313	256	569	3,772,280	5,501,175	9,273,455

PRODUCTION IN CERTAIN DISTRICTS IN 1891.

Pennsylvania.	Lehigh V.	31	33	12	45	308,068	332,691	640,759
	Schu'l "	22	21	14	35	287,650	293,843	581,493
	U. Sus. "	7	8	9	17	83,872	72,446	156,318
	L. Sus. "	19	18	13	31	261,127	222,821	483,948
	Juniata"	5	8	7	15	36,234	84,448	120,682
	Shen. "	15	15	7	22	123,896	347,653	471,549
	Alle'y Co.	24	21	5	26	647,173	988,358	1,635,531
	Mis. bit.	6	7	6	13	105.519	219,055	324,574
Ohio.	Charcoal	5	4	11	15	5,484	6,335	11,819
	H. R. bit.	9	8	6	14	59,701	50,563	110,264
	Mah. Val.	11	10	5	15	107,745	288,631	396,376
	Hock. "	4	4	10	14	28,731	31,397	60,128
	Mis. bit.	11	13	4	17	240,756	329,523	570,279
	H. R.char	8	5	7	12	8,180	13,988	22,168

PRODUCTION OF BESSEMER PIG IRON IN 1891.

New York	91,610	86,081	147,691
New Jersey	13,475	1,045	14,520
Pennsylvania	968,089	1,359,053	2,327,142
Maryland	44,800	80,044	124,844
North Carolina	1,003	2,600	3,603
Alabama	700	.....	700
West Virginia	20,977	73,420	94,397
Kentucky	.....	1,313	1,313
Texas	1,800	.....	1,800
Ohio	195,143	318,912	514,055
Illinois	179,788	425,812	605,600
Michigan	2,212	2,877	5,089
Missouri	6,194	23,634	29,828
Wisconsin	.....	7,457	7,457
Minnesota	.....	1,373	1,373
Colorado	6,661	2,870	9,441
Total	1,502,452	2,386,401	3,888,853

PRODUCTION OF BESSEMER PIG IRON IN PENNSYLVANIA AND OHIO DISTRICTS IN 1891.

Pennsylvania.			
Lehigh Valley	89,361	81,785	171,146
Schuylkill Valley	73,063	84,376	157,439
Upper Susquehanna	60,355	57,113	117,468
Lower Susquehanna	192,821	159,609	352,430
Juniata Valley	4,581	9,454	14,035
Shenango Valley	39,694	159,112	199,106
Allegheny County	443,039	673,023	1,116,062
Miscellaneous bituminous	65,175	134,281	199,456
Ohio.			
Mahoning Valley	28,095	55,754	83,849
Hocking Valley	12,330	12,865	25,195
Miscellaneous bituminous	154,718	250,293	405,011

THE SCOTCH PIG IRON TRADE.

The London *Economist* considers the annual returns issued by the Scotch Pig Iron Trade Association as the most unsatisfactory ever disclosed in connection with the Scotch iron trade. In the annual circular of a prominent iron firm the returns were regarded as highly satisfactory. The *Economist* refers to the very heavy imports of English iron into Scotland; to the heavy decrease in the exports of Scotch irons to foreign countries, both of which factors it regards as of serious moment to the Scotch iron markets. The situation thus created for the Scotch ironmaster is a very grave one, and it is hard to see how it can be amended unless by a complete alteration of the laws of procedure. Hitherto he has been stupidly conservative, and has slowly responded to the changing tendency of the consuming markets, and the result is that to-day he does not hold his own. If the Scotch ironmaster is not to go further back in the race, then he must set himself to the task of producing an iron that will compete successfully in price and quality with that which is imported. The continental markets have almost entirely gone from him, and for that the "corner" in warrants as well as the strike must be held responsible. The inflated prices which these operations created allowed other irons to get a footing, and at the present moment German and other consumers who were in the habit of taking fair quantities of Scotch iron are not even inquiring for the article.

SPIRIT OF THE TRADE PRESS.

BUSINESS TOPICS OF INTEREST.

A Big Business Reservoir.

The *Industrial World* (Chicago) depicts the present business situation in the Northwest thus: An illustration of the process and the progress may be found in the gradual formation of a pond behind a solid dam where the water had been drained away; inch by inch, the fluid contents mount up until the top-level is attained; and then little rills of excess are spurted over in swift descent to the foot of the dam, soon to be followed by brooklets of surplus, finally by an extended sheet of steady downpour. On this principle, a vast demand for commodities has been accumulating in the empty reservoir of the agricultural West, until the fullness has begun to flush over and make itself distinctly felt.

Enough Furnaces in the South.

The sooner, in our opinion, the trade learns that the furnace-building business has been overdone, in the last five years, the better for it, especially in the South. The full acceptance of this as a settled conclusion, in this section, is the condition precedent and essential to sensible diversification. If the South shall not erect another furnace for five years, except here and there one for the production of Bessemer and other special brands, she will be millions better off than if her iron men keep up through this decade the furnace building boom that characterized the last decade. We are making 2,000,000 gross tons of iron a year, working up possibly one ton in four. Instead of making our own finished materials, we make cheap pig iron that enables the mills, foundries, etc., in the North and East, to run through hard times, we buying back our own metal with a couple of freight bills and two or three profits added. This policy is simply suicidal, business stupidity of the dullest kind. We must quit it or remain secondary and dependent to the end.—[Tradesman, Chattanooga.

Iron Ore Prices in 1892.

The Cleveland *Iron Trade Review* in its last number notes that the iron men are not as "bullish" in their talk now as they were a short time since, and that where a month ago the leading producers "were certain that the advance in '92 (in the selling price of ore) would be all the way from 75 cents to $1.25, the opinion now expressed is that an advance of about fifty cents a ton will cover the cost of '92 ore." This may be so, but the price of ore for the season of '92 will be determined to some extent by the cost of getting it to market, and if an advance of fifty cents a ton would only about suffice to meet increased cost of water carriage, the same disposition on the part of mines to limit output that affected production in 1891 may be looked for during the active season of '92. The Lake Superior iron mines are, nowadays, being wrought with more reference to having them earn a reasonable profit for their owners and less with a view to achieving an enormous output than they were some years ago.—[Marquette (Mich.) Mining Journal.

Relief for the Mahoning Valley Furnaces.

Again it is reported that certain members of the Pig Iron Manufacturers' Association of the Mahoning and Shenango valleys have decided to manufacture their own coke. The report states that three of the largest pig-iron manufacturers in the Mahoning Valley and two in the Shenango Valley have joined forces and have secured options on some extensive coal lands situated in Fayette County, Pa. It is probable that additional information regarding this move will be forthcoming in a short time. The above organization has been notified that its request for lower rates on coke from the Connellsville region to the Mahoning and Shenango valleys, and on pig iron from the valleys to Pittsburgh and Cleveland, has finally been refused by the Central Traffic Association, which met at Chicago last week. The principal reason assigned by the railroads for the refusal to grant lower rates is that if the rates to and from the valleys were reduced it would be necessary to reduce rates to other points. It is not believed that any further attempts will be made by the furnacemen in the valleys for some time to secure lower freight rates.—[Iron Age.

A Lack of Black Plate in America.

"Just what I predicted six months ago has occurred. We haven't the black plate in America, and we can't get it here in sufficient quantities to make tinplate. This feature of the business has been overlooked, and until mills are established to roll the plates the industry will continue to be at the mercy of foreign manufacturers. I pointed out some time ago to the tinned plate men that black plate would be needed before tinplate could be made. I am a protectionist and prefer to patronize Americans, but by paying the duty of $1 65 cents per pound on black plate, I can still buy this material cheaper in England than in the United States. If competitors purchase there, business policy would compel me to do the same. I don't think there is any danger of the price of tinplate advancing. The Welsh manufacturers have been lying low since the tariff went into effect, and their conduct bodes no good for us My opinion is that they are getting ready to cut the wages of their men, and when the Americans think they are ready to produce tinplate on an extensive scale, the Welsh makers will make a grand and final effort to undersell them in their own market."—[James B. Scott, in Pittsburgh Dispatch.

"The fact is, we haven't mills enough in this country to supply the present demand for black plate. The business has developed rapidly, but the black plate men have not kept up with the pace. If the people will have a little patience and give us time, all these defects will be remedied. The tinplate industry has come to stay, and I don't think there is any danger of the tariff being lowered".—[W. F. Cronemeyer in same paper.

A VARIETY OF THEMES.

Recent Noteworthy Records of Iron Works.

At the Edgar Thomson Works the largest yield of steel rails for any one day of last year was 1,900 tons. The price of rails is about $1.50 per ton greater than a year ago. Improved machinery has been added to the plant in the past year which has reduced the running expenses about $200 per day.—[Pittsburgh Dispatch.

Sharpsville (Pa) furnace is making a record which is hard to beat. This furnace has made a run of five years without relining the furnace, about three years with the same back, during which time it has been damped about three times, covering a period of about seven months. The last time the furnace was damped down the fire went out. A fire was made at the bottom, and the furnace was blown in without being shoveled out, a feat seldom performed. The furnace is at present averaging over 100 tons of No. 1 Bessemer iron.—[National Labor Tribune.

That Pittsburgh Ship Canal.

The *National Labor Tribune* (Pittsburgh) does not relish *The Iron Trade Review's* reference to the proposed Pittsburgh and Lake Erie Ship Canal as a local project, in view of the fact that it is not on the line to the seaboard, and says: A project that would include as one item the moving of 3,000,000 tons of ore to Pittsburgh from the Lake Superior region partakes rather more of national than local. As to the great iron and steel center of the United States (and the greatest producer thereof in the world) not being "in the swim" [It was the canal, not Pittsburgh, that was claimed to be out of the "swim"—Ed. *Iron Trade Review*.] for the reason suggested in the second sentence—is that a necessity in a country which has the protective policy uppermost, and which consequently seeks the development of home industries and home markets rather than foreign markets? Were the public policy looking to an export trade as the leading trade the seaboard theory would be reasonable, but under the economic policy of thirty years past, of the present, and likely of the future indefinitely, Pittsburgh is near enough the seaboard at the head of Ohio river navigation, and years hence with the improvements of that river, as begun at Davis Island dam, the district will be still more convenient to its seaport, New Orleans; near enough then as now, we should say, to reach the foreign trade in iron and steel, provided this country does not want it then any more than it does now.

Test of the J. B. Hastings' Steel.

The test of converting Virginia pig or scrap iron into steel, according to the J. B. Hastings' process, came off at the South Side foundry to-day to the entire satisfaction of all who were present. The test lasted about two hours and was personally supervised by Mr. Hastings, who has in the past few months conducted similar tests from Alabama to Canada, all of which were highly satisfactory. That made to-day, however, was more rigid than any previously made, and in the opinion of the experts present fully established the fact that the new process is a complete success. By it steel of the best quality is made from the lower grade of ores, which is something that can not be done by the old process, and that the Bessemer people have never attempted. The test was witnessed by a large number of prominent people. A cold chisel was applied to a specimen of the steel made by the new process, but it not only failed to make an impression on the steel, but retired from the fight considerably battered about the edge. Much interest is felt by persons interested in the iron and steel business all over the country in the new process and the patentee and those interested with him already have received overtures from persons prominently connected with the iron ores of Virginia, to build a preliminary plant at once. The value of the new discovery can hardly be over estimated, as will readily be seen by all who are familiar with the details of the manufacture of iron and steel.—[Charleston (W. Va.) Tribune.

Among the prominent iron men present was our townsman, E. J. Bird, Jr., who tells us that the test was successful in every way. He says Mr. Hastings has a really valuable discovery. An excellent steel is made by the dropping of a little powder in the ladle in which the metal is received from the cupola. There is no doubt but the pig metal is changed into a strong steel. Mr. Bird thinks that Mr. Hastings will yet realize on his discovery. There is talk of starting an establisnment at Buchanan, for the purpose of making Hastings steel.—[Ironton (O.) Register.

WHAT THE FOREIGN PAPERS ARE TALKING ABOUT.

Serious Condition of the German Iron Market.

The year 1891 has been brought to conclusion under very unfavorable circumstances as far as the German iron industry is concerned. During the whole year there was a withholding tendency noticeable, and towards the latter part this became much more accentuated. The situation of the iron market has become very serious, and everywhere there seems to be a discordancy as far as the production of iron is concerned. The pig iron market remains in the same insufferable state. Nevertheless, the Luxemburg foundries, the sale of whose products in Germany is in one haud, have been able to maintain the same prices as before for the first quarter of this year.—[Kuhlow's German Trade Review, Berlin.

The New Spanish Customs Duties and Coal and Iron.

The Spanish official journal, last week, published the new Customs duties which are to come into operation on the 1st proximo. There are two tariffs—maximum and minimum—the latter of which will be applied to those countries which favor Spain; while the maximum will be applied to those nations which have no convention with Spain. The Government is also authorized to surtax the products or to forbid the entry of goods from countries which surtax Spanish goods or refuse them entry. Regarding coal, iron and steel, the former will pay three pesetas and 2.50 pesetas per ton; iron, in ingots, 2 40 and two pesetas; in bars, six and five pesetas; and steel in ingots, six and five pesetas: and in bars, 30 and 25 pesetas, which latter duty, on the face of it, would appear almost prohibitive. The new measure does not admit the most-favored nation clause. In connection with the new Custom duties, the mine owners and manufacturers of Bilbao have forwarded a letter of thanks to the Government for the consideration shown in

regard to mining interests in drawing up the new Customs tariff.—[Colliery Guardian, London.

Great Britain's Enormous Export Trade.

A retrospect suggested by the Board of Trade returns for the last twelve months, cannot this year be considered to be very pleasant from the point of view of our foreign trade, yet a careful examination shows that the position is not so entirely without encouragement as might as first sight appear. The returns are chiefly remarkable for showing the immense proportions of our import trade, which trade has reached the aggregate value of 435½ millions sterling. Within the past thirty years our receipts of foreign goods have almost doubled; and the progress in our exports, taking the same period, has been almost equally great—a fact, the importance of which the temporary lessening of our export trade during the past year or two must not be permitted to hide from us. Consisting as it does mainly of food and of raw materials for manufacture, this immense growth in our import trade is an element of no small significance, and should afford ground for continued cheerfulness until the present—let us hope transitory phase of trade depression has changed. To take our industrial bearings correctly, it is well to have before us a standard of comparison, the average of a number of years sufficient to include alternations of depression and of prosperity, of which alternations the business history of most countries, indeed, appears to consist. An examination of the statistics for the past twenty years, from 1872 to 1891, shows that our average imports have been £400,000,000; average exports, £300,000,000; and excess of imports over exports, £100,000,000.—[Colliery Guardian, London.

The Square Drilling Machine and its Uses.

At a recent meeting of the Civil and Mechanical Engineers Society of Great Britain, Mr. Reginald Bolton read a paper descriptive of the square drilling machine. He said that the machine was introduced to public notice in the autumn of 1890, and the practical use and capabilities of the invention had now been successfully demonstrated, with interesting results. The attainment of mechanically formed and correctly shaped angular holes placed in the power of the designer, a number of opportunities which the lack of them heretofore rendered impossible. A number of most stereotyped devices in mechanical construction were no longer rendered imperative, now that it was possible to accomplish by this machine attachments in a perfectly simple and labor-saving manner. But apart from this, there were very numerous cases where square and other shaped holes were and had always been obligatory, and which this tool would produce perfectly, in place of the doubtful result of hand labor and punching, forging and drilling. The operation of the tool stood superior to that of hand work by at least a ratio of 36 to 1, and in many cases it would produce results utterly impracticable by present methods at any reasonable cost. A curious point in the invention was that it drilled round holes with equal facility to any ordinary boring machine, and was really superior in this respect also, as various sizes might be drilled with the same tool, a perfect adjustment of diameter being provided in the machine. It would seem an almost incredible result, but it was nevertheless a fact, that a taper hole of any shape could be drilled, either larger or smaller at the bottom than at the entrance, a capability most important to manufacturers of dies. The square drill thus became a tool of almost universal application, and would appear to be a necessary adjunct to any constructive establishment, for it operated equally well in wood, brass, and stone. The operation of the machine might be described as that of a rotating drill spindle mounted in a ball joint and vibrated during its rotation against a "firmer" or template giving the desired shape. This template was made adjustable and removable, so that it was a very simple matter to change the work of the tool from a square to flat-sided outlines of many forms.

Harveyized Rails.

Since August, 1891, two rails have been lying in the track of the Delaware, Lackawanna & Western Railroad, at Scranton, which have been treated by the Harvey cementation process, the idea being to have the top of the rail, which is exposed to wear, hard, while the balance of the rail remains soft and is not subject to danger from breakage. The following analyses give the carbon at different depths:

Depth. Inches.	No. 1 rail.	No. 2 rail.
1-16.	0.76	0.76
2-16.	0.42	0.42
3-16.	0.33	0.31
4-16.	0.30	0.30
6-16.	0.30	0.30
8-16.	0.33	0.30
10-16.	0.30	0.27
12-16.	0 30	0.28
1.	0.27	0.26
1 4-16.	0.27	0.26
1 8-16.	0.27	0.25
Flange.	0.24	0.27

The railroad officials report that the Harveyized rails show less wear and flow of metal than other rails subjected to service under the same conditions. —[Iron Age.

The New Year's Business in Hardware Lines.

Traveling salesmen for the various stove and hardware establishments of the country, or at least a majority of them, have started upon the road, and the business of the year 1892 has been fairly inaugurated. In no instance, that has as yet been observed, have the forces in the field been reduced, and in many instances they have been increased to a considerable extent. This would tend to indicate that maker and seller are very hopeful of the new year. Unless indications count for nothing, they will not be disappointed, for it is probable that by the time the present year is fairly inaugurated the strengthening effect of the returning money to pay for the great crop of 1891 will begin to be felt. It is always well enough to move cautiously and conservatively, but there is every reason to believe that 1892 will be one of the most gratifying business years in recent times.—[Stoves and Hardware Reporter, St. Louis.

A CANADIAN CHARCOAL FURNACE.

Mr. William Cleary, of this city, has just returned from Radnor Forges, Chaplain county, Quebec, Can., where he has been for some time past engaged in building a new charcoal furnace to take the place of an old one at that point which ranked as one of the oldest furnaces in America, it having gone into operation about the same year the Principio furnace in Maryland did, back in the time of the old French regime in Quebec.

The new furnace has been built by the Canada Iron Furnace Co. (Ltd.), whose works are at Radnor Forges, with headquarters at Montreal, a concern that has a paid-up capital of $200,000 and does an extensive business. It is situated on the line of the Canadian Pacific Railway, and in the center of what is said to be the largest deposit of bog ore in the world, that of the Three Rivers district, Quebec. The company owns and controls 60,000 acres of iron ore rights in addition, including Lac-a-Tortue, where there is an immense deposit of ore. The company also owns and controls extensive timber limits on the St. Maurice river, whence the wood can be either carted to its charcoal kilns at Grand Piles, close to the furnace, or floated to that place by river. At this point the company owns an undeveloped water power estimated at 35 000 horse-power. At Three Rivers it also owns a very valuable property, among its possessions there being a car wheel foundry and docks. From the latter, situated on the River St. Lawrence, shipment can be made to England by ocean steamer direct, and ore can be received from all the great iron fields, including the Lake Superior districts.

The new furnace plant consists of a single stack, nine feet bosh, five feet at bottom and six at top, and 40 feet from the bottom to the bell-top. It is entirely completed, and will go into operation on the first of next month, or with the beginning of the new year. The iron produced will be largely consumed in car wheel works in which the leading stockholders in the company are interested, among these being those of the Montreal Car Wheel Co. and the St. Thomas Car Wheel Co. The iron produced in the old furnace had gained a high reputation for excellence, and was sought particularly for the manufacture of car wheels, for which use it was found equal in every respect to the high grade Salisbury irons. The demand for the iron for this purpose is what decided the company to enlarge its facilities, and the capacity of the plant will be further increased as demand indicates the desirability of this.

The officers of the company are P. H. Griffin, President (that gentleman being also president of the New York Car Wheel Co., whose works are at Buffalo, N. Y., and of the St. Thomas Car Wheel Works, at St. Thomas, Ont.); Geo. E. Drummond, Managing Director, and Thomas A. Drummond, Secretary. The former is president of the Montreal Car Wheel Co., Montreal, and also a member of the firm of Drummond, Call & Co., of the same city, and the latter is general manager of the Montreal Car Wheel Co., as well as being connected with the powerful firm named above. These gentlemen, with Jas. T. McCall, of the Montreal firm in which his name appears, and Robert Schott, a steel manufacturer of Sheffield, Eng, constitute the directory of the company. Mr. Cleary says the company's new furnace is a modern one in every respect, and equipped with every improvement.—[Marquette (Mich.) Mining Journal.

Sensational Metallurgical Discovery in Germany.

It is reported in Westphalia that the experiments of several experts have resulted in the invention of a process of manufacturing pig iron which will revolutionize the iron industry. The simultaneous application of the electric current and the use of an easily made acid for extracting the iron from the ore are said to be the chief characteristics of the new method. The experiments were confined to the raw material forming the blast furnace charge, and are said to have proved completely successful, the separation of all metallic substances being rapidly and perfectly effected, and the iron left in an absolutely pure condition. The process is stated to be 80 per cent. cheaper than the present blast furnace method. The invention has been patented in all countries, and it is proposed to form a company with a capital of 50,000,000 marks (£2,500,000). Until further particulars are to hand, this sensational report must naturally be regarded with a certain amount of suspicion. The idea of producing pig iron by the aid of electricity is, of course, not novel. If we recollect aright, a Lorraine iron works made similar experiments some years ago; but these failed in their object, notwithstanding that the direct assistance of Mr. Edison, who at that time was resident in Europe, was available because it was found that the process was not adapted for working on a large scale.—[Glasgow Engineer.

Building in 1891.

The *Northwestern Lumberman* says "building operations in St. Louis during 1891 involved nearly as great an expenditure as in 1890, while the number of buildings erected was larger. Permits were issued calling for an outlay of $13,262,170. Milwaukee, in proportion to size and population, did better than St. Louis, expending more than $10,000,000 in new structures. Next to Chicago, St. Louis and Milwaukee, of all Western cities, made a growth that should be gratifying to their citizens and property owners. One year ago a Chicago sash and door man prophesied that during 1891 building in the larger cities of the country would fall behind, from the fact that the larger undertakings of that character were carried on with borrowed capital, and money at that time seemed unlikely to be readily obtained in large blocks by borrowers. He seems to have struck the nail in the vicinity of the head. Building fell short of expectations in the larger cities, and the effects of a tight money market were felt more or less all over the country."

Personal.

In the description of the model plant of the Walker Manufacturing Co., on other pages of this issue, the name of the architect and consulting engineer, Mr. F. Felkel, was inadvertently omitted. Mr. Felkel makes a specialty of designing and constructing modern manufacturing plants.

APPARATUS FOR SUPPLYING MOTIVE FLUID TO ENGINES.

Benjamin Brazelle, of St. Louis, has recently invented a new and useful improvement in methods of and apparatus for supplying motive fluid to engines.

The object of the invention is to attain as high an economy as practicable in the operation of fluid-pressure engines by utilizing the expansive force of motive fluid from any determined initial pressure, whether comparatively high or low, to a fixed low or zero terminal, irrespective of variations of load or initial pressure—in other words, to enable the maximum economy to be attained whether the duty of the engine requires the development of its maximum or its minimum power.

Under present practice an engine which may operate economically when exerting, say, one hundred horse-power will not be found economical when operated at ten horse-power, and hence no material range of variation of load is usefully admissible. Further, in the operation of an engine in which a desired terminal pressure is attained, when steam is worked at maximum pressure, and with a determined degree of expansion the terminal will be found to fall much below atmospheric pressure with the attendant loss due to condensation and re-evaporation when cutting off shorter for lighter loads or higher pressure. Again, in automatic cut-off engines it is not practicable to effect perfect regulation within any material range of variation of load or pressure.

This invention is designed to obviate the objections which, as above indicated, obtain in present practice; and, generally stated, it consists in a method of and apparatus for coincidently changing the degree of expansion or point of cut-off and the degree of initial pressure, in accordance with variations of pressure or load, or both, in the operation of an engine, expansion being varied in reverse direction to the variation in ordinary practice—that is to say, the point of cut off being made earlier in accordance with increase of load or pressure and later in accordance with decrease, while the same fixed low terminal is reached in all cases. The load-line is so regulated as to be brought to the fixed terminal by varying the point of cut-off, as above stated, and the pressure-line is correspondingly and coincidently regulated by varying the initial pressure from which expansion is effected.

In the practice of this invention as applied in the operation of engines of the present standard construction a cut-off mechanism and a fluid-supply valve are coincidently acted upon by a regulating mechanism of any suitable construction, so as to simultaneously vary the degree of initial pressure and the point of cut-off, raising the former and shortening the latter in accordance with required increase of power, and, conversely, lowering the former and lengthening the latter in accordance with required decrease of power. Such variation may be effected by the employment of two governors or regulators, one of which acts upon the cut-off mechanism and the other upon the throttle or supply valve, or by a single regulating mechanism of such construction as to be adapted to act simultaneously upon the cut-off mechanism and the throttle-valve.

In the accompanying drawings, Fig. 1 is a view, partly in elevation and partly in section, of so much of an engine adapted to the practice of this invention as is necessary to explain the same; Fig. 2, an indicator diagram such as would be produced under the invention, and Fig. 3 an indicator diagram such as is produced in the operation of an ordinary automatic cut-off engine.

The drawings illustrate the application of this invention on an automatic cut-off slide-valve engine of the ordinary type, the distribution-valve being actuated and controlled by a loose eccentric and cut-off governor on the main shaft, and the steam-supply being controlled by an ordinary centrifugal throttling governor connected to the steam-pipe and valve chest. Motive fluid is admitted through the inlet 5 and governor valve 4 to the valve-chest 1^a and thence through the ports 16 16^a to the cylinder 1, acting upon the piston 2, which, through the usual connections, rotates the crank-shaft 10^a. Motive-fluid supply is regulated by a throttling-governor 3, and variation of the degree of expansion or point of cut-off is effected by a cut-off governor or regulator X, mounted on and rotating with the crank-shaft. The governor X is composed of a supporting disk or case 7, fixed upon the shaft 10^a a pair of centrifugally-acting weights 12, connected to arms 13, which are pivoted to the case and coupled by links 14 to an arm 11, carrying a movable eccentric 8, and a centripetally-acting spring 15, coupled to the case and to the eccentric carrier arm 11. A slot 9 is formed in the eccentric 8, through which the shaft 10^a passes, and the rod of the eccentric 8 is connected with the slide distribution-valve 6 in the ordinary manner.

The engine may be assumed to be speeded to one hundred revolutions per minute and to develop fifty horse-power with one hundred pounds initial pressure cut off at one-twentieth of the stroke, the steam expanding down to five pounds terminal pressure. Should the load be reduced or pressure increased, the speed of the engine would be slightly increased, causing the throttling-governor 3 to partially close the valve 4, thereby reducing the supply-pressure. At the same time the weights 12 of the shaft-governor X move outwardly, and, through their arms 13 and the links 14, move the eccentric 8 traversely to the shaft, increasing the throw of the eccentric and the travel of the distribution-valve 6, thereby effecting a greater degree of opening of the ports 16 16^a and cutting off later in the stroke. When the load is increased or the pressure reduced and the speed of the engine thereby reduced the throttling governor 3 will open the valve 4, thereby increasing the initial pressure in the cylinder, and at the same time the weights 12 of the cut-off governor X will move inwardly, when the spring 15 will move the eccentric 8 in the opposite direction, reducing its throw and the travel of the valve, thereby effecting a lesser degree of opening of the cylinder-ports and cutting off shorter. The coincident action of the supply and cut-off governors, as above described, is exerted in accordance with all changes of load and steam-pressure.

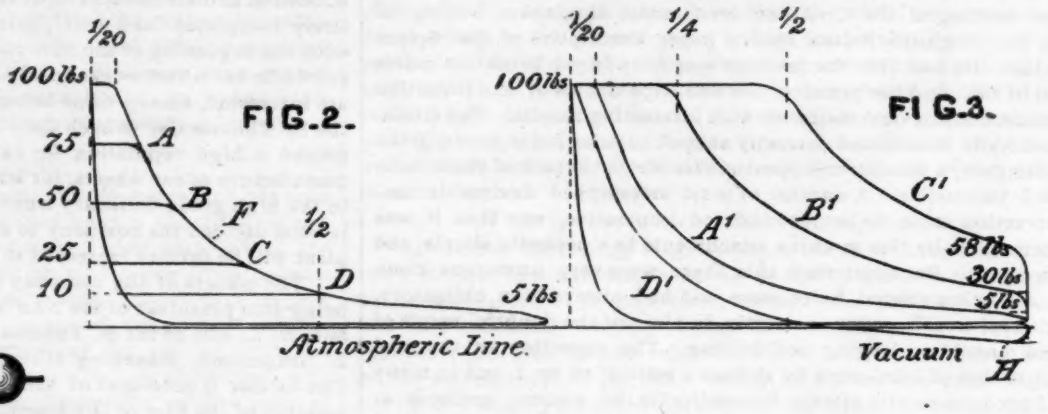


FIG. 2.

FIG. 3.

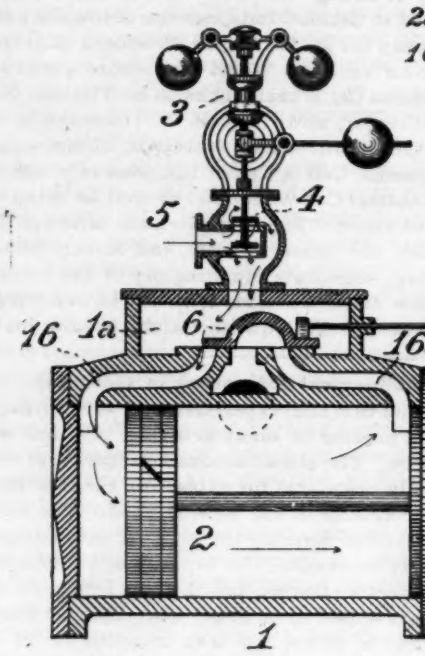
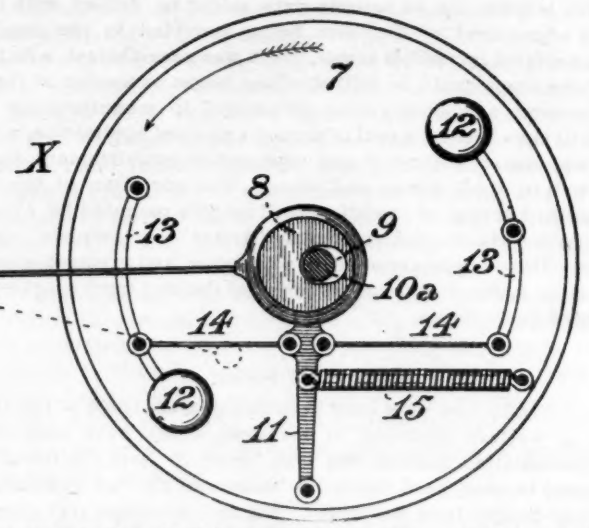


FIG. 1.



The diagram Fig. 2 indicates the different points of cut-off corresponding with variations of initial pressure. If the initial pressure falls to seventy-five, fifty, twenty-five, or ten pounds, the point at which steam is cut off will be indicated by A, B, C, or D, respectively, the terminal pressure being in each case five pounds or the determined terminal or zero of the normal initial pressure of one hundred pounds. Upon a proportionate decrease of load the initial pressure is reduced by the throttling-governor 3 to seventy-five, fifty, twenty-five, or ten pounds, and the point of cut-off changed by the cut-off governor X to that indicated by A, B, C, or D, respectively, the terminal pressure being in each case five pounds. Under other variations of load or initial pressure, occuring either independently or coincidently, the degrees of initial pressure and points of cut-off would be indicated by points between the lines A, B, C, and D, but on the same expansion-line F and resulting in the same fixed terminal.

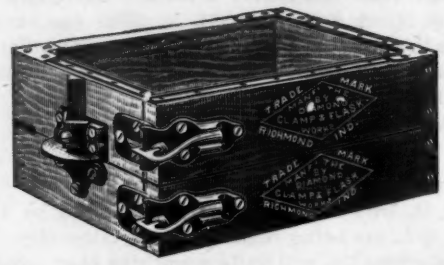
From the diagram Fig. 3, which indicates the results of the ordinary method of using steam expansively in automatic cut off engines, it will be

seen that when the initial pressure is one hundred pounds and the steam is cut off at one-twentieth of the stroke the terminal pressure is five pounds; but when, with an increase of load, the steam is cut off at one-quarter of the stroke the terminal pressure is thirty pounds, and when, with a maximum load, the steam is cut off at one-half the stroke the terminal pressure is fifty-eight pounds. With a minimum load the steam is cut off at so early a period in the stroke as to cause a vacuum to be formed in the cylinder, as indicated by the loop H, the disadvantage of which in resultant condensation and re-evaporation is well understood. The expansion curve with minimum load is shown by D'.

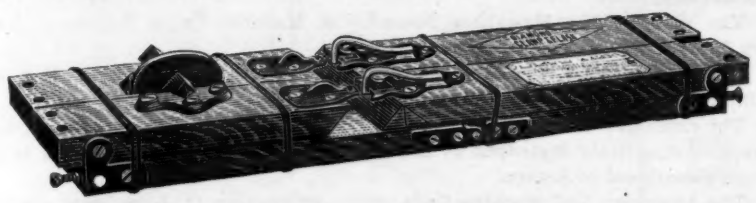
In this improved method, with maximum load, steam at an initial pressure of one hundred pounds is cut off at one-twentieth of the stroke, giving a terminal pressure of five pounds, and with a minimum load the initial pressure is reduced to ten pounds and steam is cut off at one-half stroke, giving a terminal pressure of five pounds.

THE DIAMOND FOLDING SNAP FLASK.

A new device of much interest to foundrymen is herewith illustrated. These flasks have been invented by a pattern-maker who has had years of experience, and after a careful study of the wants of molders. They are manufactured by machinery put together by templets, all interchangeable on pins, and war-



ranted to fit perfectly. They are made only of the best lumber, maple and beech, one inch thick, well seasoned, and finished with pure shellac varnish. A special light binding on top and bottom of flask prevents wearing, being superior to old style binding, with one-third the weight, hence an acknowledged advantage over heavy bound flasks. They are constructed to be folded and shipped "knocked down"— an economy in space, and convenience in shipping; made in standard sizes to be carried in stock with other foundry supplies, and can be made in special sizes to order. They can be put together



by any molder, without the use of any special tool, in a few minutes. They have given fullest satisfaction wherever used, resulting invariably in duplicate orders because of convenience, durability and absolute economy of time in the shop. Manufactured only by the Diamond Clamp & Flask Works, Richmond, Ind.

The Latest Thing in English Armor Plates.

The whole of the compound armor for H. M. S. "Royal Sovereign" has been supplied by the firm of Messrs. Charles Cammell & Co., Sheffield, according to Wilson's patent. It was delivered with great promptitude, and, as it was all erected at their works previous to its being forwarded to Portsmouth, the plates dropped into their assigned places without their having to be touched up by machinery. The belt armor weighs 1,096 tons, and varies in thickness from 18 in. to 14 in., tapering below the waterline. It has a depth of about 8 ft. 8 in., and extends 252 ft. amidships, a length of protected area which rendered it expedient to adopt a reduced maximum thickness as compared with the belt of the "Trafalgar." The aggregate weight of the bulkheads is 170 tons. They vary in thickness from 16 in. to 14 in., and are tapered in the vertical section. The two barbettes are pear-shaped in plan, the greater diameter, which is armored to a thickness of 17 in., being 38 ft. 2 in. The small end is bent to a radius of 6 ft., and the armor is 11 in. and 16 in. in thickness. Each barbette measures 54 ft. 1 in. in extreme length, and the weight of steel-faced armor forming the structure is 650 tons. The conning tower has an inner diameter of 9 ft. 8 in., and is built of 12 in. and 14 in. armor, of a total weight of 48¾ tons. The four casemates for the protection of as many quick-firing guns, though not peculiar to the "Royal Sovereign," having been supplied by the same manufacturers to the "Hawk" and "Endymion," nevertheless must be numbered among the novelties of her equipment. They are composed of 6 in. plates in two sections, and are beat to difficult curves, requiring very intricate and delicate machine work to adopt them to the exigencies of the design. This armor was the last to be supplied to the ship, and, notwithstanding its special contours and character, Messrs. Cammell anticipated the demands of the builders in the delivery of the plates. The secondary armor for the protection of the sides and screens above the belt is manufactured of specially prepared armor steel. It has a thickness of 3 in, and 4 in. and weighs 223 tons. The armor specified represents an aggregate of 2,902 tons, and is secured by 125 tons of bolts; and if to this is added the protective steel decks, the aggregate of armor carried by the battle ship will amount to 4,500 tons.—[Iron and Steel Trades Journal.

THE coal industry of the United States furnishes employment to 300,000 persons, to whom $110,000 is paid in wages, and the capital invested is estimated at $350,000,000.

SOUTHERN IRON IN THE NORTHWEST.

It is easy to prophesy, but it is another matter entirely to read the future. Southern coke pig iron continues to be sold largely in the Northwest despite the predictions so often made of late years that it was destined soon to be shut out. The advent of more local producers in the Northwestern field has not had the expected effect. It seemed to be perfectly natural conclusion that in a time of restricted trade the competition of local makers would be so great that the Southern companies would find themselves cut out completely. Such a period has just been experienced. Low as the Northern irons were sold, the Southern makers manfully met the situation, and made prices accordingly. There have been some very large contracts placed within the past two or three months which the Northern furnacemen were anxious to get, but which were captured for Southern makers. It has been claimed so long that the low prices realized for Southern iron would land the producers in bankruptcy, while as yet there has been no general financial embarrassment among them, that this tune is about worn out, and is seldom heard. The persistence with which the South keeps up the fight, with undoubtedly a very light margin of profit, is beginning to elicit admiration for the pluck of its manufacturers.

The fact is conceded, however, by those who handle Southern pig iron in the Northwest that they have not had their share in the increased consumption of pig iron in that territory. There has been a tremendous growth in this respect within the past five years. The manufacturing interests of the Northwest have gone forward with great strides in that time, and have carried with them an ever increasing demand for pig iron. This enlarged demand has been met by the increased number of local furnaces making foundry pig iron. Five years since there was but one concern, the Chicago Furnace Co., making foundry pig iron at Chicago, and it ran but one stack, finding the market a tight squeeze sometimes in placing this limited output. Later the Bay View furnaces, at Milwaukee, were diverted by the North Chicago Rolling Mill Co. to the manufacture of foundry pig iron, but rather intermittently. After the organization of the Illinois Steel Co. the production and sale of foundry pig iron became a regular part of their business. The Northwestern Iron Co. and the Minerva Furnace Co. then entered the field for local favors, but did not continue so regularly as the others. The past Summer the Iroquois Furnace Co. joined the ranks of the Chicago furnacemen and are now an important factor in the field. With this steady advance in the production of local pig iron the Southern coke iron trade in the Northwest has remained nearly stationary, but it has nevertheless held its own quite remarkably under the circumstances.

The representatives of Southern furnaces assign special reasons for their failure to gain a good slice of this increased business. Price has played a much less important part than would be imagined. The great hold which Northern manufacturers have secured upon the local trade has been by their willingness to make long contracts. It is not uncommon, but quite the reverse, for a large consumer to place his requirements for a whole year with a Northern furnace company. This is done even when prices are very low. The Southern companies are for the most part disinclined to do this. Occasionally a company can be found which will make such a contract, but it is an exception. The consequence is that the large consumers, who have been educated to anticipating their full season's requirements, only take one-third or one-fourth of the Southern iron which they would take if they could contract for the whole year. But this is not all. It is alleged that the Southern companies act as if they looked upon their Northwestern trade as merely a temporary matter. They do not regard their patrons as in any sense their customers, whose favor it is desirable to cultivate and preserve. This is not a new development, but is a peculiarity which has been noted for years. It might be supposed that by this time they could have been convinced that they could retain a considerable portion of Northwestern trade, and that it would be well to adopt the measures necessary to accomplish that purpose.—[Iron Age.

Electric Arc Welding Abroad.

One of our English contemporaries has recently given a very complete account of the Bernardos arc welding process, as operated at the tube works of Lloyd & Lloyd, in Birmingham, which we reproduce in our columns this week. Arc welding and the Thomson process seem to occupy quite distinct fields. The arc method has its peculiar usefulness in connection with large work in which the electric arc serves simply as a means of communicating very intense heat at the particular point necessary. As will be seen from the article in question, it is applied with great effect to the manufacture of tubes, and gas, steam and water fittings generally. Until its introduction the makers were dependent on a powerful blowpipe for doing this rather delicate class of work, but the electric arc from its great power and convenience, has proved to be immensely more effective than any form of blowpipe yet devised, in fact Lloyd & Lloyd report that the cost of the weld by this process is only one-fourth that which was usual when the blowpipe was employed. It will be noted that the Bernardos process is also widely different from the Coffin system of arc welding, which has already been used in this country. Of the two it must be confessed that Mr. Coffin's method is the more pleasing, since by the action of a magnet it converts a powerful arc into a blowpipe which can be handled so as to apply just the right amount of heat at just the point necessary. By the Bernardos process the arc is drawn between the metal itself and the carbon electrode. Inasmuch as the work forms the positive pole, the heat generated is very intense, but the process gives the impression of being less handy than the one just mentioned. It is certainly successful, and enables a class of work to be very readily done which would be impossible by any other process. For example, fittings 12 inches in diameter can be made out of 5-16 metal cheaply and rapidly, a feat which would be exceedingly difficult, if not impossible, to perform by other means. Apparently, arc welding has come to stay, at least in its application to certain classes of work.—[Electrical World.

INDUSTRIAL SUMMARY.

New Enterprises:—

The following recent incorporations, specially reported for *The Iron Trade Review*, are of interest to the iron and machinery trade:

Detroit, Mich.—Tuite-Rein Co; capital, $60,000; for the manufacture and sale of special devices for heating and lighting; incorporators: Thos. P. Tuite, Burnard Rein, Jno. C. Ryan, all of Detroit, Mich.

Chicago, Ill.—The Robinson Siphon Burner Co.; capital, $250,000; to manufacture and sell smoke preventing and fuel saving devices; incorporators: Frank T. Robinson, A. L. Dickinson, Isaac E. Adams.

Chicago, Ill.—The Chicago Cash Carrier Co.; capital, $250,000; to manufacture and deal in cash and parcel carriers, and any other device or merchandise; incorporators: E. S. Skinner, Joseph D. Folley, J. F. Bartlett.

Jenison, Mich.—The Jenison Manufacturing Co.; capital, $100,000; for the manufacture and sale of agricultural tools, etc; incorporators: Luman Jenison, Jenison, Mich; A. S. Blake, and O. C. Taylor, of Grandville, Mich.

Geddes, N. Y.—Mohawk Furnace Co.; capital, $30,000; for the purpose of smelting and reducing iron ore and manufacturing pig iron; incorporators: Wm. Pigott, Wm. D. Hopkins, Harry T. Whigham, all of Syracuse, N. Y.

Towanda, Pa.—The Towanda Chair Co.; capital, $35,000; for the manufacture and sale of chairs or any article of commerce from wood or metal, etc.; incorporators: N. N. Betts, Charles L. Tracy, both of Towanda, Pa; E O. Macfarlade.

Detroit, Mich.—Detroit Graphite Manufacturing Co.; capital, $10,000; to mine graphite, iron, copper and other ores and manufacture products therefrom; incorporators: R. A. Parker, F. C. Trowbridge, Jas. T. Sterling, all of Detroit, Mich.

Philadelphia, Pa.—The Central Cycle Co.; capital, $25,000; for carrying on the business of manufacturing bicycles, tricycles, etc.; incorporators: Ellwood Horn, 2618 N. 11th street; Jno. C. Sullivan, 1605 Mt. Vernon street: F. W. Middendorf, 1910 N. 13th street.

Onawa, Monona County, Ia.—The Onawa Manufacturing Co.; capital, $5,000; to manufacture the Hill patent dry air refrigerator together with all necessary appliances for their use; incorporators: M. A. Freeland, A. W. Mann, John Hill, all of Onawa, Ia.

Dayton, O.—The Maxon Detachable Steel Chain Belting Co; capital, $50,000; for the purpose of manufacturing and selling chains, link belting and link belting machinery, etc; incorporators: Thos. Maxon, Thos. Staniland, E. C. Boyer, Henry Coleman, Jos. A. Wortman.

Brooklyn, N. Y.—The Lowey Manufacturing Co.; capital, $10,000; to manufacture and sell household specialties and silverware; incorporators: Frederick Lowey, 252 Bergen street, Brooklyn, N. Y.; W. Lowey, Flatbush, N Y.; Ed. Meyer, 252 Bergen street, Brooklyn, N. Y.

Golden, Ill.—The Golden Specialty Manufacturing Co.; capital, $20,000; for the purpose of manufacturing the Richardson step ladder and the Richardson ironing stand and such other articles as may be legally acquired; incorporators: Laban Cain, Robt. W. Alexander, Seneca Selby.

New York City, N. Y.—Automatic Car Coupler & Fastener Co. (incorporated in W. Va.); capital, $2,500,000; for the purpose of manufacturing and selling car couplers and locks and fasteners, etc.; incorporators: Benj. D. Traitel, E. H. Sentenne, Albert Birchman, all of New York City, N. Y.

Chicago, Ill.—Street Car Bell Co.; capital, $50,000; to manufacture and deal in bells and other signals for street cars, and to hold and use and license others to use inventions and improvements in such bells and signals; incorporators: Harriett M. Gibbs, E W. McClellan, Joseph Cummins.

New York City, N. Y.—The Henry Huber Co. (incorporated in W. Va.); capital, $250,000; for mining coal and iron, manufacturing and dealing in brass, iron and other goods, pumps and plumbers supplies; incorporators: Henry Huber, Adolph Fiedman, F. H. Jones, all of New York City, N. Y.

Belleville, Ill.—The Karr Supply Co; capital, $20,000; for the purpose of dealing in leather, machinery, supplies, manufactured metals and general merchandise, also gas and steam fitting, plumbing and operating machine shops; incorporators: Theodore Karr, Martha Karr, Adam Karr.

Chicago, Ill.—The Hecla Manufacturing Co; capital, $150,000; to manufacture, sell and deal in machinery, hardware and similar articles and do a general manufacturing and mercantile business as the company may find expedient; incorporators: Fred A Rowe, Frank G. Gardner, Solomon Victor.

New York, N. Y.—The Bottlers' & Brewers' Machine Manufacturing Co.; capital, $12,000; for the manufacture and sale of machinery, tools, etc., used by bottlers and brewers, etc; incorporators: Wm. M. Schurnker, 12 Cliff street, N. Y.; David Mueller, 175 Prince street, N. Y; Philip Kranz, 13 Tompkins place, Brooklyn.

Rochester, N. Y.—The J. T. Schaffer Manufacturing Co.; capital, $125,000; for the manufacture and sale of all kinds of machinery, hydraulic presses, and to manufacture material for producing pails, caskets, railroad ties, etc; incorporators: Jno. Chamberlain, Rochester; Jno. T. Schaffer, Rochester; Wm. M. Bennett, Rochester, N. Y.

East St. Louis, Ill.—Rumsey & Sikemeier Co; capital, $200,000; to manufacture and deal in all kinds of machinery, mechanical apparatus, tools, implements, metals, materials and supplies, hardware and general merchandise, and handle any of the above goods on commission and conduct a general mercantile business; incorporators: Wm. C. Rumsey, H. Sikemeier, Margaret Sikemeier.

OTHER NEW ENTERPRISES.

The boiler making firm of Tippett & Wood, at Phillipsburg, N. J., have been incorporated, with a capital stock of $20,000.

The Kittselman Wire Fence Co, of St. Thomas, Ont., is being organized, with a capital stock of $10,000, for the manufacture of wire fence goods, etc.

D. H. McMullen, G. M. Armour and Thomas Winsor have incorpoaated the Ballard Electric Co., with a capital stock of $25,000, at Washington, D. C.

John H. Parker, F. E. Knight, Chauncey J. Weatherby and others have incorporated the Parker & Knight Co., at Baltimore, Md., for the manufacture of machine tools, etc. The capital stock is $25,000.

The American Radiator Co., Detroit, has been organized with a capital stock of $8 400 000. The company includes the Pierce Steam Heating Co., of Buffalo, N. Y., the Michigan Radiator Co., and the Detroit Radiator Works, of Detroit.

The Leonard Manufacturing Co. has been incorporated, at Hartford, Conn., by the Secretary of State, to manufacture corn harvesters and other agricultural and mechanical implements and tools at New Hartford. The capital is $30,000.

The New Castle Tin Plate Co. have been organized at New Castle, Pa., with a capital stock of $150,000. The incorporators are W. S Foltz, Jno. Stevenson, Jr., Geo. Greer, Jno. Fahnline, Frederick Lehberger, M. S. Marquis, J. P. Cunningham, of New Castle, and S. W. Cunningham, of Pittsburgh. As soon as the necessary organization has been effected, it is the intention of the new company to erect a plant at New Castle for the manufacture of tin and terne plates.

The Mekarsky American Compressed Air Motor Co, recently incorporated at Albany, N. Y., is to manufacture and sell compressed air motors, air compressors, and all other machinery necessary therewith. Location of its business will be at North Tarrytown, N. Y. The company has a capital of $1,000,000, which is to consist of cash, patent rights and other property. The directors are Edward C. Nichols, of Dunkirk; George E. Whipple, of Westfield, Mass.; C. P. Laurenson and E. F. Abel, of Baltimore; and Addison C. Randall, J. F. Lewis and C. B. Johnson, of New York City.

Additions, Enlargements, Removals, Etc.:—

The Lancaster, O., Iron Works, recently purchased by the Indiana Iron Works, of Muncie, Ind., are being removed to the latter city.

The Whittier Machine Co. will build a machine shop 140x82 feet at Granite and First streets, Boston. The building will be of brick, with monitor roof.

At South Lawrence, Mass., the Emerson Manufacturing Co. have begun the erection of a new machine shop. The main building will be 375x40 feet, and the foundry 100x60 feet.

Fires and Accidents:—

The Syracuse Steel Works, at Syracuse, were destroyed by fire the 7th inst. The loss is $45,000.

The plant of the Houghton Foundry & Machine Co., at Toledo, O., has been damaged by fire to the extent of $25,000

The round house, machine shop and blacksmith shop of the B., B. & K. R. R., at Bradford, N Y., have been burned. The loss is $25 000.

The extensive works of the Thomas D. West Foundry Co., Cleveland, O., were almost entirely destroyed by fire on the 13th inst. The total loss is in the neighborhood of $25,000.

The American Nail Machine Co.'s works, at Findlay, O., have been almost totally destroyed by fire, involving a loss of $30,000. The works had recently been purchased by the Wellington Manufacturing Co., of New York, who were remodeling them preparatory to putting in a steel car manufactory.

On morning of 15th inst., the works, tempering, grinding and wood work departments of the Canton Saw Co., Canton, O, were partially destroyed by fire. While this will cause some delay in filling their orders, yet they expect to be able to ship this week. Their mill dog department has not been damaged and there will be very little delay in filling orders for mill dogs.

The following correction has been received from the company concerning the loss by fire to the shops of the Louisville & Nashville Railway, at Decatur, Ala., mentioned in last week's *Iron Trade Review*: "The whole amount of loss including building and cars will not exceed $14,000, and no men at all were thrown out of employment, as our work is still going on. There were only 12 repair cars destroyed, instead of 50."

General Industrial Notes:—

The Springfield Boiler & Manufacturing Co., Springfield, Ill., are in need of a steam riveter, boiler slate planer and a power blacksmith hammer.

The Totten & Hogg Iron & Steel Foundry Co., Pittsburgh, Pa, are running night and day, in both the machine shop and roll turning department.

The following firms have recently placed their contract for a sprinkler equipment with the Neracher Sprinkler Co., Warren, O: Worthen & Aldrich, Soho, N. J; Parrott & Taggart, Indianapolis, Ind.; Cleveland Baking Co., Cleveland; Stolzenbach Bakery, Zanesville, O.; American Chair Manufacturing Co., Brandts, Pa.; Stoddard Building, Brooklyn, N. Y; F. G. Oxley Stave Co., Poplar Bluff, Mo; Armstrong Furniture Co., Evansville, Mo.; Silas Kilbourne & Co., Grand Rapids, Mich.; Brown Manufacturing Co., Zanesville, O.; Upson Nut Co., Cleveland; Piedmont Paper & Pulp Co., Piedmont, W. Va., West Virginia Paper Co., Piedmont, W. Va.; Northern Ohio Blanket Mills, Cleveland; Church Paper Co., Rock Falls, Ill.; Armour Packing Co., Kansas City, Mo.

Fire Losses in 1891.

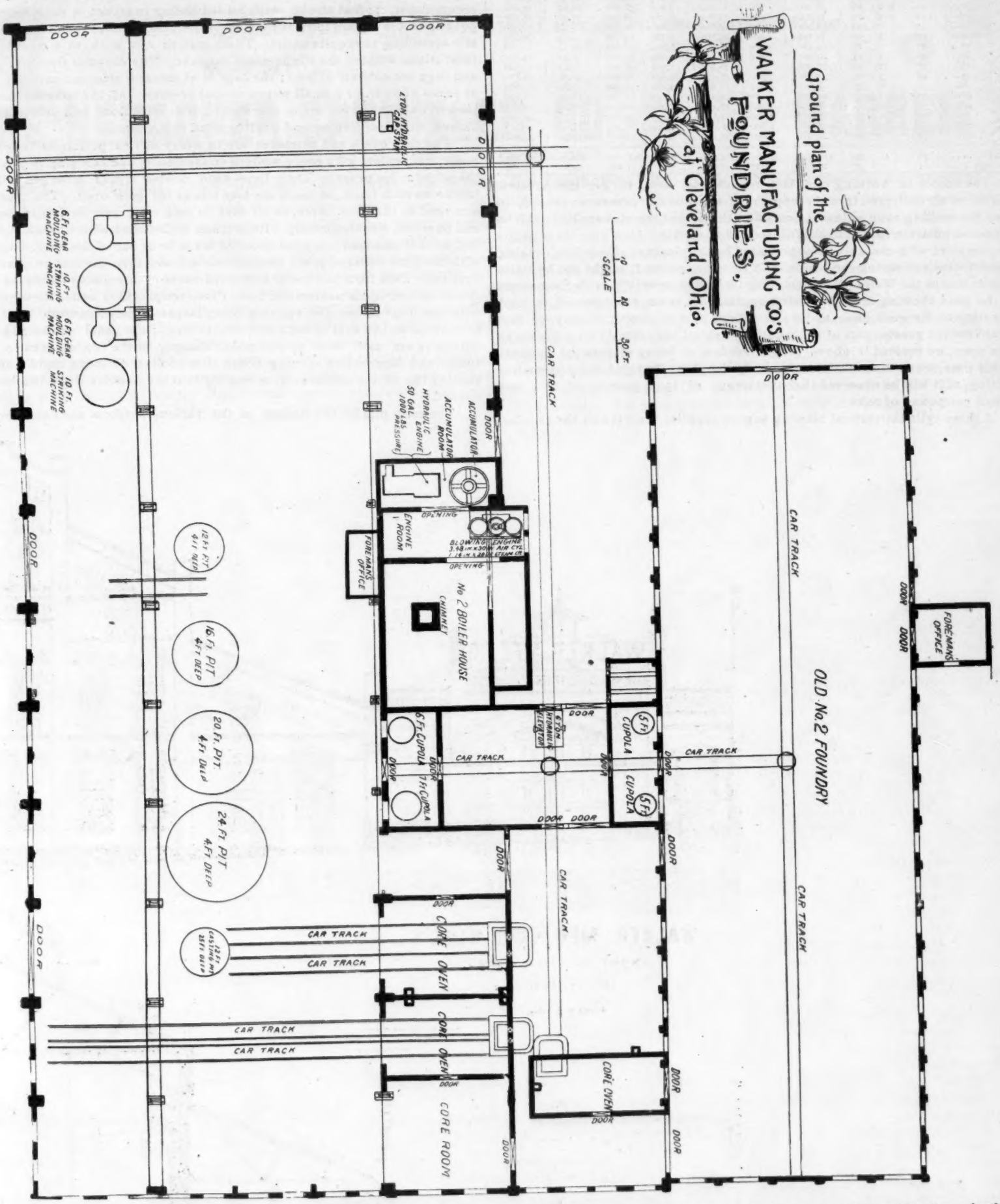
The losses by fire in the month of December in the United States and Canada are estimated by the New York *Bulletin* at $13 535,500, which brings the total for the year 1891 up to $137 716,150; this is nearly $30,100,000 more than in 1890, but only about $6,000 000 more than in 1889. The average for the past six years was about $124 300,000 per annum, so that the loss in 1891 was about $13 400,000 more than the average. The *Bulletin* says: "The outlook for 1892 seems somewhat more favorable in view of the better trade prospects and the improved conditions among the underwriters."

A MODERN IRON FOUNDRY.

To the courtesy of the *Machinery Moulders' Journal* (Detroit) we are indebted for the accompanying cuts showing the extensive shops of the Walker Manufacturing Co., Cleveland. The *Journal* says:

Accompanying this article our readers will see an elevation and cross section view of the shop, also a ground plan view, showing the interior arrangement.

As we said before, the illustrations show the foundry departments exclusively, as we have not thought it necessary to give any view of the machine, pattern, blacksmith or erecting shops, which lie to the left of the illustrations, and are, if anything, on a more magnificent scale, the whole combining to make a series of imposing structures of which not only Cleveland but America may be proud.



No. 1 foundry is 300 feet long by 118 feet wide, and is built in three bays, the centre one being 57 feet wide and 41 feet under the tie beams, and 62 feet to the highest point of the roof. This bay is used for making the larger and heavier work, and is provided with two traveling cranes of 30 tons capacity each, and which are able to lift a 24-foot casting vertically out of a pit, and still have plenty of clear space in which to carry it from one end of the shop to the other. The side bays are each provided with two 12-ton cranes operated by separate engines.

No. 2 foundry is fitted with five 6-ton traveling cranes, so that every foot of space on the foundry floors is available for work, and can be reached with a crane.

The cupolas for the small work foundry have 60 inch diameter shells, while those for the large foundry have 72-inch and 84-inch shells, lined to 52, 60 and 72 inches inside diameter respectively. They are supplied with Walker's patent doors, balanced, with automatic catch to hold them in vertical position when dropped, so as not to warp and burn the edges of the doors in the drop. They are also supplied with a continuous blast breeching and continuous tuyere in the form of vertical slots, 1x4, 1¼x5 and 1½x6 inches, for the different size cupolas. This form of tuyere is the result of many experiments and much thought by Mr. Walker, and has been adopted and in successful operation for several years with extraordinary results, as may be seen by reference to the accompanying table, in which the fuel for bed is included and no credit given for coke in drop.

The following are the performances of a cupola in Foundry No. 1, the

shell of said cupola being 72 inches in diameter and the inside diameter of lining being 60 inches. There was an 8-ounce blast, and the amount of coke named in this table includes the bed in each case:

Date.	Heat No.	Blast Duration. H.	Blast Duration. M.	Pounds No. 1 Pig.	Pounds No. 2 Pig.	Pounds Scrap.	Pounds Coke.	Total Pounds Iron.	Pounds Iron Melted to 1 lb. Coke.	Pounds Iron Melted Per Hour.
August 6...	39	3	45	45,400	2,000	36,600	5,990	84,000	14.02	22,380
" 7...	40	3	50	43,600	2,000	35,400	5,663	81,000	14.30	21,120
" 11...	41	2	00	28,000	800	21 200	3,906	50,000	12.80	25,000
" 12...	42	2	15	17,200	2,000	16,800	2,765	36,000	13.01	15 990
" 13...	43	1	20	12,400	800	12,800	2,226	26,000	11.68	19,500
" 14...	44	3	00	32,100	1,200	25,700	4,175	59,000	14.13	19,665
" 15...	45	4	25	54,400	3,200	42,400	6,663	100,000	15 03	23.100
" 17...	46	2	15	17,500	800	14,703	2,655	33,000	12.42	14,655
" 18..	47	2	30	28 200	.....	20,800	3,542	49,000	13.83	19,600
" 19...	48	3	20	22,700	7,600	31,700	4,892	62,000	12.67	18,600
" 20...	49	1	30	6,600	2,400	11,500	2,087	20,500	9.82	13,665
" 21...	50	3	20	20,250	1,200	19,550	2,549	41,000	11.55	12,300
" 24...	51	1	21	6,750	2,400	11,350	2,060	20,500	9.95	15-375
" 25...	52	1	40	16,300	2,000	15,700	3,005	34,000	11.31	20,400
" 26...	53	2	55	36,600	4,800	36,600	5,844	78,000	13.34	26,740
" 27...	54	2	20	28,850	1,000	22,150	4,025	52,000	12.91	22,200
Totals	16	41	45	416,850	34,200	374,950	63,047	826,000	202.15	309,290
Average	1	2	36	26,053	2,137	23,435	3,940	51,625	13.10	19,784

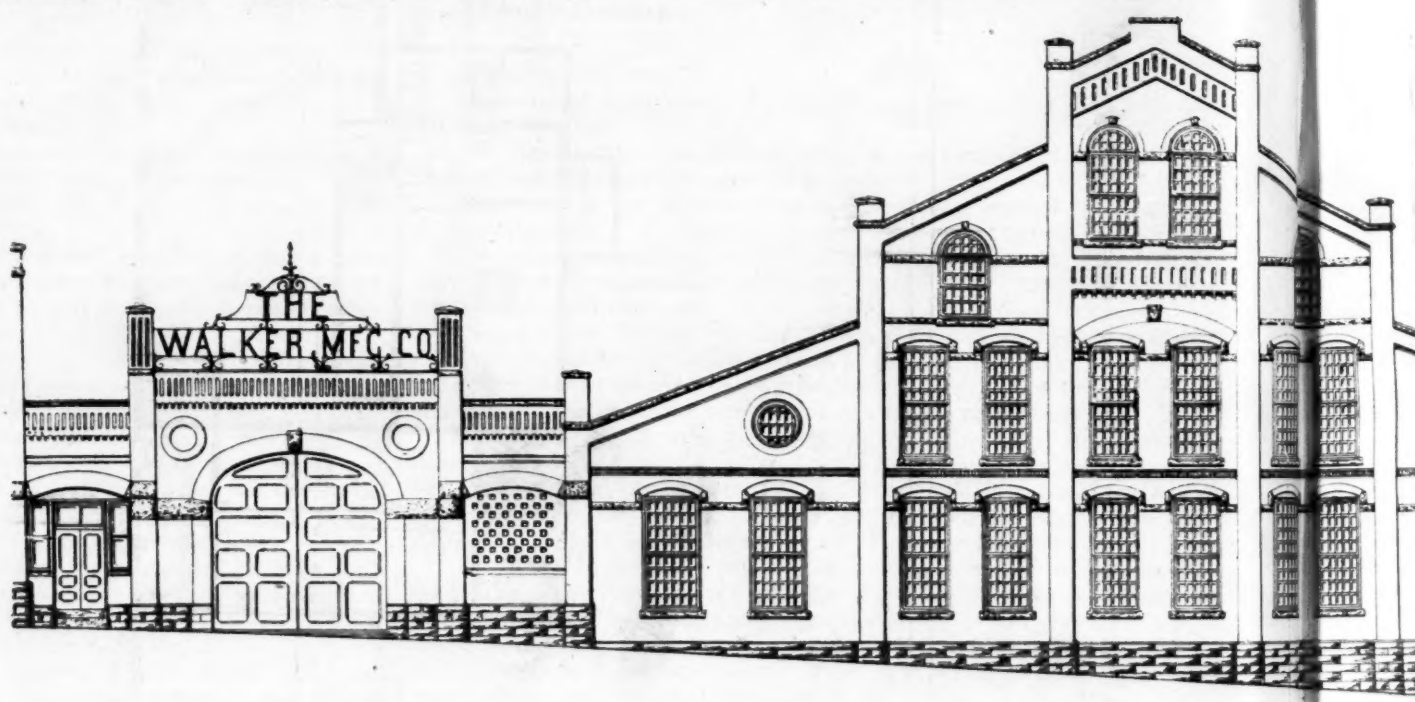
The theory in working out this tuyere was, first, to get the greatest amount of air delivered into the cupola at a minimum pressure; second, to keep the melting zone as low as possible; third, that the air supplied shall be as near as possible spread to the full section of cupola. How near these points are complied with can only be appreciated by the pleasure afforded in running such cupolas and seeing the results. In this connection it might not be amiss to state that at the Walker Manufacturing Co.'s they especially pride themselves on the good showing made by their cupolas, and as an exact record is kept every day of the work done, and we have been able to secure a copy of that record for the greater part of the month of August last, shortly after the works were open, we present it above to our readers as being of especial interest at this time, when so much attention is being given to rapid and economical melting, as it will be observed that an average of 13.10 pounds of iron was melted per pound of coke.

A three-cylinder vertical blowing engine supplies blast for all the cupolas. The air cylinders are 48-inch bore by 30-inch stroke. The air valves have a positive motion, worked with eccentrics and rocker arms. The steam cylinder is 14 inches diameter by 30-inch stroke; its piston is coupled with rod of centre air cylinder. The valve of steam cylinder is worked by a lever and link from the upper end of one of the outer air cylinder piston rods. This engine is the acme of simplicity; its working and results are in keeping. It was built by the company, and since its introduction they have decided to build four sizes for foundry, steel works and smelting purposes.

The hydraulic system used for elevating all the material for the four cupolas, etc., is very simple and complete, and is entirely automatic. A 14-inch accumulator, 14-foot stroke, with loaded casing to secure a pressure of 1,000 pounds to the square inch, is used, and differential pumps operated automatically according to requirements. These pumps can work at a speed of 150 revolutions without the slight water hammer. The elevator framing, girders and cage are entirely of iron; the cage is of unusual size, and can take a load of 12,000 pounds, or a small wagon of coal or coke. All the coke for the cupolas and coal for the boilers is elevated to the third floor and dropped to the second, thus avoiding second hauling of all this material.

The core ovens and carriages are in every way as perfect as they can be made, and replete with every modern convenience, one being 24 by 30 feet, and the other 20 by 30 feet. They have each double tracks arranged with two trucks on each track, so there are four trucks for each oven. The trucks are arranged so that two, three, or all four in each oven can be joined together and operated simultaneously. Each truck is provided with a crank and gearing, so that one man can wind a loaded truck in or out of the oven, dispensing with the time-honored pinch bar and half a dozen men for this purpose. The ovens are fired from the back, and have covered fire-places inside to shield the cores and molds nearest the fire. Flues are provided under the oven floors, with openings on top, the opening being larger as they approach the door, so as to equalize the heat at both ends of the oven; the usual smoke and damp chimneys are used, with an additional damper at the top of oven to let out smoke and heat before opening doors, thus cooling off more rapidly and preventing the smoke and heat from coming into the foundry when the doors are opened.

The sand pits for the storage of the various kinds of sand and clay used

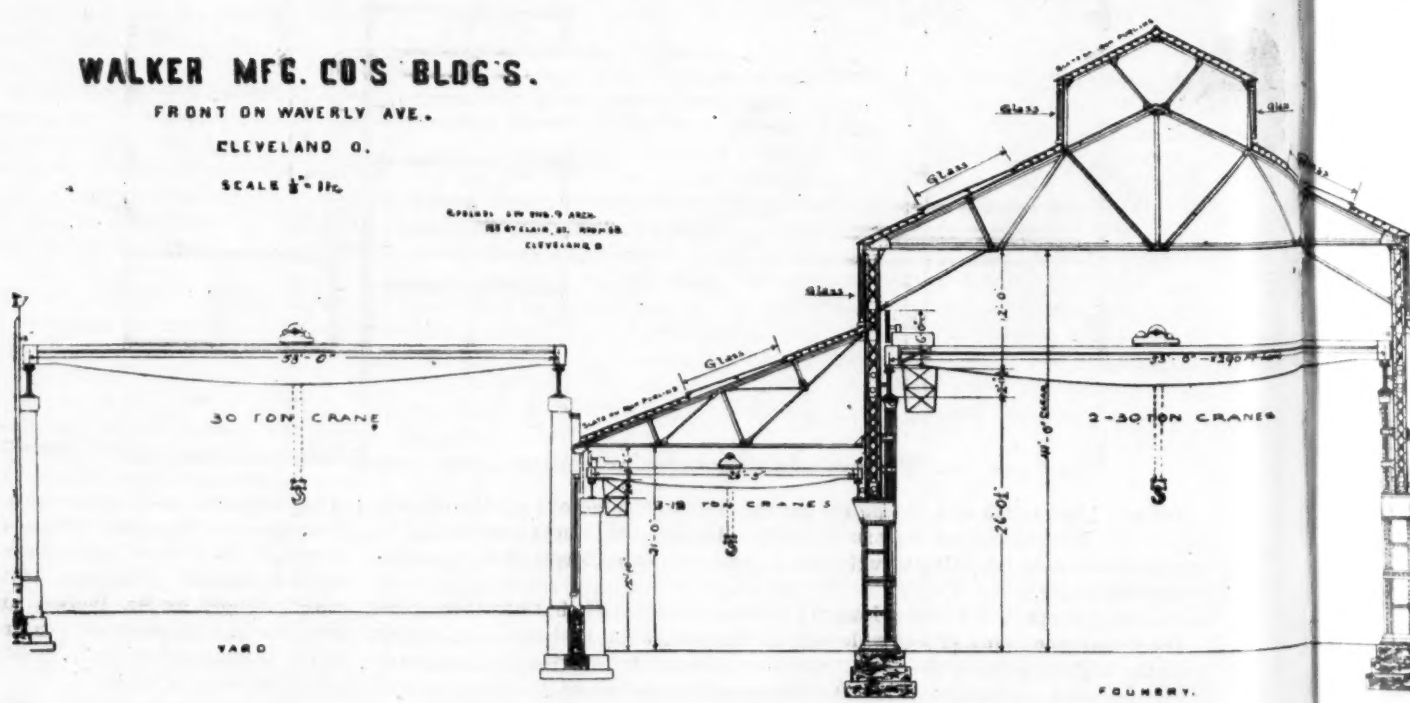


WALKER MFG. CO'S BLDG'S.

FRONT ON WAVERLY AVE.

CLEVELAND O.

SCALE 1/8" = 1 Ft.



PROTECTING YOUR BUILDING With an automatic fire sprinkler system makes it absolutely fire proof. All Insurance Companies recognize the "Neracher" as the best made and will make liberal reductions on your present rates if you equip. In this way the system pays for itself inside of two years' time.

☞ Write us.

THE NERACHER SPRINKLER CO., - WARREN, O.

BRANCH OFFICES:

Boston, Chicago, St. Louis, Cleveland, Cincinnati, Minneapolis, Pittsburgh, New York, Philadelphia, Baltimore, San Francisco.

are 14 in number and are most conveniently located, being built of brick under the yard, on one side, with openings in the top through which wagons can dump their loads directly into the pits, and from which there are openings in the side which communicate through a subterranean passage with the foundry. They are arched at the back end with 3-foot arches on top, with 15-inch steel I beams, and are a grand success, the sand always being in good condition. This is accomplished by having a 6-inch drain with laterals placed immediately under the floor, thus draining the entire series.

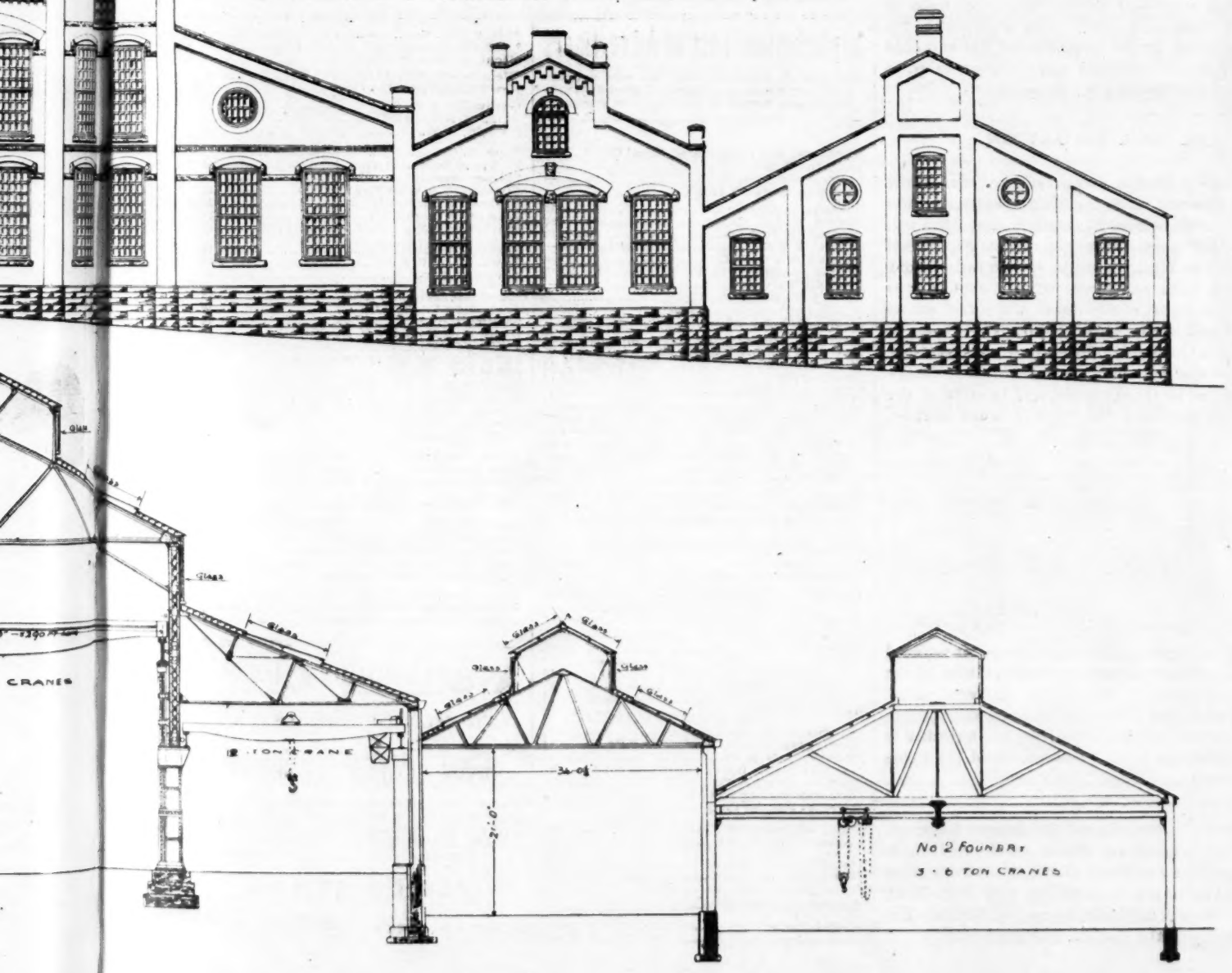
There are five permanent casting pits—12, 16, 20 and 24 feet in diameter and 4 feet deep for large pulleys, gears, etc, and one 12 feet in diameter and 25 feet deep for casting hydraulic cylinders and rams on end and similar work of great length.

The crane ladles used are the most substantial imaginable, ranging in capacity from 3 to 25 tons each; they can pour from either side, and can be used for right or left positions as the pouring may require.

The shop is heated with hot air, which is driven into the shop by a Sturtevant blower 10 feet in diameter, with an outlet 42 inches square, which is capable of displacing 50,000 cubic feet of air per minute.

The foundry is ventilated if necessary by the same means by turning on a current of fresh air that will materially affect the atmosphere under the most trying conditions.

The works are supplied with a 4-inch service water pipe and a 4-inch fire line pipe, each running the entire length of the works, and laterals into all departments. The foundries are supplied with 20 upright pipes, each with a



The Hackney Power Hammer

The Measure of Excellence and Profit.

The durability of the machine and the quantity—with quality—of work produced, is nowadays the measure of excellence and profit, and in this respect the "Hackney" is far in the lead.

It surpasses other power hammers in durability, speed and quality of work.

Write for catalogue and prices.

THE HACKNEY HAMMER CO.
Cleveland, O.

stop valve, a drinking tap and a ¾-inch hose bib, so that when hose pipe for sprinkling the molding sand, etc., may be connected, the drinking tap will be available, and should either or both of these be disabled the stop valve can be used to shut the water off without stopping the water from any of the other uprights. At each upright a sheet iron tank 6 feet long, 2 feet deep and 2 feet wide is supplied, and has waste pipe connected with drain, all of which water is turned into a large cistern in the yard. All the water from the casing of deep casting pit, also all the water from the roofs of both foundries, is collected in the same cistern for use in the boilers.

The entire hydraulic machinery and all its appurtenances was built by the company, being designed and erected under the supervision of Mr. E. W. Naylor, whose system of hydraulic machinery the company has adopted.

A narrow gauge railway runs through the yard to the elevator, and with turn-tables reaches all the various points where material and work are to be delivered.

In the light-work foundry, which is 200 feet long by 58 feet wide, there is the most complete set of pulley-molding machines and appurtenances for same that was ever designed; the interchangeability of the parts is simply wonderful.

The floor system of molding pulleys is equally complete, and shows the result of years of experience in this line of work.

The gear-molding machinery, which is situated in the large foundry, is complete in every detail, including both fixed and portable machines, also striking machines of the most improved form.

All the pulley and gear molding machinery is of special character, invented and patented by Mr. John Walker. The production of machine-molded pulleys and gears by the Walker Manufacturing Co. has been unprecedented in quantity and quality. They are used from Maine to Mexico, and recently some gearing was sent to Africa.

The shops are all brilliantly lighted by electricity, both arc and incandescent. The foreman's office is very neat and convenient. The light is excellent, coming from both sides, ends and roof. The wash-room for employes is convenient, and provided with ample supplies of hot and cold water, and altogether the erection of these foundries can be considered as marking an era in the improvement of past customs and systems.

ONCE MORE, THE STEEL RAIL SITUATION.

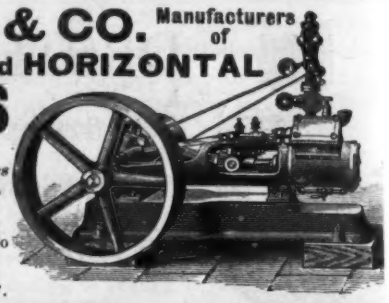
Eastern mills report very little new business, and no sales of magnitude are reported. The Western mills are reported to be booking heavily, and the outlook is so encouraging that Eastern mills believe it possible that they will be able to sell in Western territory this year. It is regarded as likely that before May some buyers will find that the Western mills are so full of work for the busy months that they cannot take additional orders, even if they divert capacity from billets. The official report of the Board of Control shows that shipments of standard rails, 50-lb. and over, were 1,089,092 gross tons, so that with light rails the production was probably close up to 1,225,000 tons. This is the lowest since 1885, in spite of the fact that since then the mileage of the country has risen from 128.363 miles to 171,841 miles, and in spite of the fact that the average weight of rails now put into the track is much heavier. The record since 1881 is appended:

Years.	Miles in operation.	New mileage.	Production Steel Rails. Gross tons.
1881	103,143	9,847	1,187,770
1882	114,712	11,569	1,284,067
1883	121,455	6,743	1,148,760
1884	125,379	3,924	996,983
1885	128,363	2,984	959,471
1886	136,400	8,037	1,574,703
1887	149,279	12,879	2,101,904
1888	156,204	6,925	1,386,278
1889	161.397	5,193	1,479 267
1890	167,741	6,344	1,797,489
1891	171,841	4,100	1,225,000

Rail makers argue from this array of figures that a good deal of renewal work has been held back, and must come up this year. Developments in the money market are also decidedly encouraging. The M., K. & Texas issue we learn, has been subscribed three times over. Money is accumulating rapidly at this financial center, and a revival of railroad repairing and building is looked forward to this Summer. The Chicago mills have advanced the price of rails $1 per ton. The East still quotes $30 at mills.—[Iron Age.

THE Council of the American Society of Mechanical Engineers have appointed a committee to devise and recommend a series of efficiency tests of engineering appliances. On this committee are Chas. E. Emery, who was in charge of the steam boiler tests at the Centennial Exposition, and Prof. R. H. Thurston, of Cornell University, who was a commissioner to the Vienna Exposition of 1873, and a member of the jury of the Paris Exposition of 1889.

THE JAMES LEFFEL & CO. Manufacturers of
IMPROVED UPRIGHT and HORIZONTAL
ENGINES & BOILERS
3 TO 26 HORSE POWER.
STRONGLY BUILT on BEST Principles for SMOOTH and ECONOMICAL WORK.
Over 4000 in Use.
Write for free PAMPHLET and state your wants to
THE JAMES LEFFEL & CO.
SPRINGFIELD, OHIO or NEW YORK CITY.



ROLLS. EST B. AND 1863 PINIONS.
THE TOTTEN & HOGG IRON & STEEL FOUNDRY CO.
OFFICE & WORKS
24TH ST & A.V.R.R.
PITTSBURGH PA
CHILLED & SAND ROLLS
ROCK CRUSHERS,
SHEARS SQUEEZERS AND ROLLING MILL MACHINERY.

ENGRAVINGS
OF MACHINERY
And Manufactured Articles
OF EVERY DESCRIPTION
SEND PHOTO OR DRAWING FOR ESTIMATE
UNION PHOTO-ENG CO
25 WATER ST. CLEVELAND, OHIO.

Alphabetical List of Advertisers

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month the double dagger (‡) once in three weeks.

	PAGE
Aitchison, Rob't Perforated Metal Co	15
Adt, John & Son	15
†Armstrong Bros	—
American Bridge & Iron Co	14
Buckeye Engine Co	20
Burton, W. J. & Co	14
Bischoff, F. F. & Co	16
*Berger Mfg. Co	—
Babcock & Wilcox Co	20
Buffalo Specialty Mfg. Co	18
†Butman Furnace Co	—
Barr Electric Mfg. Co	17
Cleveland City Forge & Iron Co	20
Cleveland Twist Drill Co	20
Cleveland Iron Mining Co	13
Cleveland Rolling Mill Co	13-16
Cleveland Desk Co	13
Condit Fuller Co	13
*Copeland & Bacon	—
Colliau, Victor	18
Canton Iron Foundry Co	—
Cambridge Roofing Co	19
Cole, J. Wendell	20
Chester Steel Casting Co	20
Corrigan, Ives & Co	13
Canton Saw Co., The	20
Deming Co	18
Dixon, Jos., Crucible Co	15
Downerd & Son Co., The J	15
Egan Co	15
Edison General Electric Co	15
Eberts Bros	20
Eclipse Electrotype & Engraving Co	16
Frank & Co	18
Fleharty, J. H & Co	16
Fitzgerald, W. T	14
Graham Twist Drill Co	20
Garvin Machine Co	15
*Garfield Injector Co	—
Garry Iron Roofing Co	19
Graves, L. S. & Son	15
Gerlach, Peter & Co	16
*Gillette & Lewis,	15
Hutchison, W. S	20
Harrington & King Perforating Co	13
*Hodell, H. H. & Co	19
Hartford Steam Boiler Insp. & Ins. Co	16
Hackney Hammer Co	12
Hartman Sliding Blind Co	16
Hercules Powder Co	18
Iron Clad Paint Co	19
Industry File Works	20
Jones, E. H. & Co	18
Jeffrey Mfg. Co	14
Jenks, James	12
Kanneberg Roofing Co	19
*Leffel, Jas. & Co	19-12
Ladd, Alfred W	17
Milton Mfg. Co	15
*Munn & Co	—
Michigan Emery Wheel Co	17
*Neracher Sprinkler Co	11
New Philadelphia Iron & Steel Co	13
Outhwaite, J. H. & Co	13
Oglebay, Norton & Co	13
Oldfield, L. H	16
Pope, E. C	13
Parkin & Bosworth Co	20
Palmer, Cunningham & Co	14
Pittsburgh & Wheeling Coal Co	13
Penberthy Injector Co	20
Pollock, Wm. B. & Co	18
Pratt Chuck Co, The	18
Rogers & Hubbard Co	14
Rowell, Geo. P. & Co	15
Reynolds Bros	20
Schleicher, Schumm & Co	18
Sykes Iron Roofing Co	19
Sackman, F. A	14
Southwark Foundry & Machine Co	19
Stirling Co	18
Stilwell & Bierce Mfg. Co	20
Spicer Mfg. Co	15
Shepard, H. L., Agent	17
Skinner Engine Co	19
Stevens, F. B	19
*Simpson, Thos. P	16
Sterling Grate-Bar Co	14
Toledo Machine & Tool Co	18
Tod, Wm. & Co	18
Totten & Hogg Iron & Steel Foundry Co	12
Van Duzen Gas Engine Co	16
Upson Nut Co	16
Union Electrotype Foundry	14
Universal Radial Drill Co	20
Unger & Wigham	19
Union Photo Engraving Co	12
West, Thos. D. Foundry Co	14
Westinghouse Machine Co	19
Wyckoff, Seamans & Benedict	18

A SPLENDID CHANCE

TO ESTABLISH YOURSELF IN A

Good Paying Business.

I have for sale a small MACHINE SHOP with good Tools, now manufacturing specialties and a good jobbing trade offered. LOW RENT. Can work into a big business. Call on or address

JAMES JENKS.

Dealer in Machinery, DETROIT, MICH.

PERFORATED METALS OF EVERY DESCRIPTION BY THE HARRINGTON & KING PERFORATING CO. CHICAGO.
284 Pearl St., cor. Beekman. NEW YORK.

IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, net cash) Bessemer, $15 70; No. 1 Foundry, $15 20; No. 2 Foundry, $14 70; No. 1 Gray Forge, red short, $14 20; No. 2 Gray Forge, neutral, $14 20; No. 1 American Scotch, $15 70; No. 2 American Scotch, $14 70.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1. foundry, $16 00 @16 75; Southern Coke No. 2 Foundry, $15 25 @16 00; Southern Coke No. 3 Foundry, $14 25 @15 00; Southern Coke No 1, Softeners, $15 00 @15 75; Southern Coke No. 2, Softeners, $14 50 @15 25; Ohio Silveries No. 1, $17 50@18 50; Ohio Silveries No. 2, $16 50@ 17 50; Ohio Strong Softeners No. 1, $18 00@19 00; Ohio Strong Softeners No. 2, $17 00@18 00; Lake Superior Charcoal Nos. 1 to 6, $17 25@18 50; Tennessee Charcoal No. 1, $1700@18 00; Tennessee Charcoal No. 2, $16 50@17 50; Southern Standard Car Wheel, $21 00@23 00; Tennessee Standard Car Wheel, $00 00@00 00.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $14 75@15 25; Southern coke, No. 2 and No. 1 soft, $13 75@$14 25; Hanging Rock Coke, No. 1 foundry, $16 50@17 00; Jackson Co. Stone Coal, No. 1 foundry, $16 50@17 00; Tennessee Charcoal, No. 1 foundry, $17 00@17 50; Hanging Rock Charcoal, No. 1 foundry, $19 75 @21 00. MILL IRONS—Standard Southern Coke, grey forge, $12 50@12 75; Standard Southern Coke, mottled, $12 25@12 50; Cold Short Southern Coke, grey forge, $12 75@13 00; Strong Ohio Neutral Coke, grey forge, $15 00@15 50. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $19 00@20 00; Tennessee Car Wheel, $18 00@19 00; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $16 00@16 50; Mahoning and Shenango Valley strong, No. 2 Foundry, $15 00 @15 50; Ohio Softener No. 1, $16 20@16 50; Ohio Softener No. 2, $15 20@15 50; Jackson Co., Silvery No. 1, $18 00@00 00; Jackson Co. Silvery, No. 2, $17 00@00 00; Lake Superior Charcoal, $18 50@00 00; Tennessee Charcoal, $18 25@00 00; Southern Softener No. 1, $15 75@00 00; Southern Softener No. 2, $15 00@00 00; Southern Strong No. 1 Foundry, $16 75@00 00; Southern Strong No. 2 Foundry, $15 75@00 00' Alabama Car Wheel, $19 75@20 75; Hanging Rock Char coal, $21 00@22 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 00@14 25; Southern coke No. 2, $13 25@13 75; Southern coke No. 3, $13 00@13 25; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 00@17 00; Southern charcoal, No. 2, $15 50@16 00; Missouri charcoal, No. 1, $17 00@17 50; Missouri charcoal, No. 2, $16 50@17 00. FORGE—Neutral coke, $12 50@12 75; Cold short, $12 25@12 50; Mottled, $11 50@12 00. CAR WHEEL AND MALLEABLE—Southern (standard brands), $18 00@ 18 50; Southern (other brands), $17 00@17 50; Lake Superior, $19 50@20 50.

ST. LOUIS (reported by Rogers, Brown & Meacham): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 25@15 50; Southern Coke No. 2, $14 50@14 75; Southern Coke No. 3, $13 75@14 25; Southern Grey Forge, $13 00@ 13 25; Southern Charcoal No. 1, $17 00@17 50; Southern Charcoal No. 2, $16 25@16 75; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@ 19 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $19 50@20 00; Southern, $19 50@ 20 00. CONNELLSVILLE COKE—East St. Louis, $0 00; St. Louis, $5 65.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $17 00@18 00; Lake Superior (coke) Bessemer, $16 50@17 00; Katahdin (Maine charcoal), $00 00 @00 00; Lake Superior Coke, Foundry, all ore, $17 50@18 00; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1 $16 25@16 50; Southern Gray Forge, $14 00@ 14 50; Jackson County (Ohio) Silvery, $18 25@ 18 75; Old Car Wheel, $00 00@00 00. Connellsville Coke, $0.00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 25@ 14 75; Southern Coke No. 2 Foundry $13 50@ 13 75; Southern Coke No. 3 Foundry $12 75@ 13 25; Grey Forge, $12 50@13 00; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $15 75@16 75; Car Wheel, $17 75@19 75.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $15 50@16 00; No. 2 Foundry, $14 50@15 00; Grey Forge, $13 50@13 75; White and Mottled, $13 00@13 25; Warm Blast Charcoal, $18 00@22 00; Cold Blast Charcoal, $22 00 @26 00; Bessemer, $15 25@15 75.

MERCHANT IRON AND STEEL.

Flat Bar

1½ to 4 by ⅛ to 1 inch	1 70
4½ to 6 by ⅛ to 1 inch	1 85
1½ to 6 by 1¼ to 2 inch	2 15
1¼ & 1¾ by ¼ to ½ inch	1 85
1 & 1¼ by ¼ to ½ inch	1 95
⅜, ½ and ⅝ by ¼ to ½ inch	2 15

Round and Square.

1 to 1⅞ inch	1 75
2 to 2¾ inch	1 95
2¾ to 3¼ inch	2 25
3⅜ to 4 inch	2 75
4¼ to 4½ inch	3 25
4¾ to 5 inch	3 45

Ova

⅜ to 1¼ inch	2 15
⅜ to ½ inch	2 25
⅝	2 55
¾	2 95

Half Oval and Half Round.

⅜ to 1 inch	2 85
⅜ to 1¼ inch	2 45
⅜ to ½ inch	3 05
⅝	3 25
¾	4 75

Heavy Band.

½ to 6 by ¼ and 5-16 inch	1 55
½ to 1½ by ¼ and 5-16 inch	2 05
½ to ¾ by ¼ and 5-16 inch	2 25
½ to ¾ by ½ and 5-16 inch	3 75

Hoops.

1¼ to 4, Nos. 13 to 15	3 55
1¼ to 2, Nos. 16 to 18	3 65
1¼ to 2, No. 19	3 75
1¼ to 2, No. 20	3 85
1¼ to 2, No. 21	3 95
1¼ to 2, No. 22	4 05
15-16, 1 and 1¼, Nos. 13 to 15	3 75
15-16, 1 and 1¼, Nos. 16 to 18	3 85
15-16, 1 and 1¼, Nos. 19 and 20	3 95
15-16, 1 and 1¼, No. 21	4 05
15-16, 1 and 1¼, No. 22	4 15
⅞, Nos. 13 to 15	3 95
⅞, Nos. 16 to 18	4 05
⅞, Nos. 19 and 20	4 15
⅞, No. 21	4 25
⅞, No. 22	4 35
13-16, Nos. 13 to 15	4 15
13-16, Nos. 16 to 18	4 25
13-16, Nos. 19 and 20	4 35
13-16, No. 21	4 45
13-16, No. 22	4 55
¾, Nos. 13 to 15	4 25
¾, Nos. 16 to 18	4 45
¾, Nos. 19 and 20	4 55
¾, No. 21	4 65
¾, No. 22	4 75
11-16, Nos. 13 to 15	4 55
11-16, Nos. 16 to 18	4 65
11-16, Nos. 19 and 20	4 75
11-16, No. 21	4 85
11-16, No. 22	4 95
⅝, Nos. 13 to 15	4 75
⅝, Nos. 16 to 18	4 95
⅝, Nos. 19 and 20	5 05
⅝, No. 21	5 15
⅝, No. 22	5 25
⅝, No. 23	5 45

Light Band.

1¾ to 6 by ⅛ to 3-16 in	2 20
1¾ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ⅛ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅜ and 13-16 by ⅛ to 3-16 in	2 70
⅜ and 1 3-16 by Nos. 11 and 12	2 80
⅜ and 11-16 by ⅛ to 3-16 in	3 00
⅜ and 11-16 by Nos. 11 and 12	3 10
⅜ and 9-16 by ⅛ to 3-16 in	3 30
⅜ and 9-16 by Nos. 11 and 12	3 40
½ by ⅛ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	2 80
⅜ inch, " " " 13 and 14	3 00
½ inch, " " " 11 and 12	3 10
½ inch, " " " 13 and 14	3 30

Sheet Iron.

No. 10 to 14	2 45
No. 15 to 17	2 55
No. 18 to 21	2 75
No. 22 to 24	2 85
No. 25 to 26	2 95
No. 27	3 25
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 25
C No. 1, " "	2 40
C H No. 1 " "	2 50
C H Flange, " "	3 50
Extra Flange, "	4 00
Solid Fire Box "	4 75

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 25
Shell	2 50
Flange	2 75
Marine Flange	3 00
Fire Box	4 00

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c ℔ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1⅛c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s
1 to 2 in. inclusive	8
9-16 to ⅞ in "	8½
7-16 to ½ and 2⅜ to 3 in	9
3⅛ to 4 in	9½
⅝ to 11-16 and 4⅛	10
⅝ to 6 in	10½
¼ to 9-32 and 6⅛ to 7 in	11
3-6 in	13

Flats.

	cts. ℔s
2 to 9-16 wide by 2 to ⅝ thick	8

Bessemer and O. H. Steel.

Machinery base price,	2 35
Tire "	2 25
Spring "	2 80
Sleigh Shoe "	2 50
Toe Calk "	2 35
Cutter Shoes, tapered and burr. "	2 75

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	15"

Burden Boiler Rivets.

⅜, ½, 11-16 and ⅝ inches diameter	4 00
Bridge ⅜, ½, 11-16 and ⅝ inch diam	4 00

SCRAP IRON AND OLD METAL.

NET TONS	
No. 1 R. R. wrought scrap	$18 00
No. 1 wrought scrap	16 50
No. 1 Machine cast scrap	11 50
Iron axles	23 50
Axle turnings	13 50
Wrought turning (free from cast)	11 50
Cast borings	8 00
Uncut wrought iron boilers	11 50
Steel boiler plates	16 00
Grate Bars	8 00
Pipes and flues (Clean)	12 00

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	12 00
Tank iron	12 50
Hoop and band iron	9 50
Sheet iron	8 50
Wrought drillings	11 00
Malleable iron	9 50

CLEVELAND ROLLING MILL CO.,
MANUFACTURERS OF
BESSEMER AND OPEN-HEARTH STEEL,
Blooms, Billets, and Slabs. Steel Rails, Steel Beams, Channels and Angles. Steel Forgings. Bar, Spring and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire. Iron and Steel Plates. Galvanized and Black Sheet Iron and Steel. Corrugated Iron Roofing.

CATALOGUES Printed in the Highest Style of Art, by The Cleveland Printing & Publishing Co., Cleveland, O.

PITTSBURGH & WHEELING COAL CO.,
MINERS AND SHIPPERS OF
Ohio Steam Coal and Coke.
Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.
Office, 6 Mercantile Bank Building, CLEVELAND, OHIO.
Lake Shipping Point, Lorain O.
JAS. PATTERSON, Sales Agent.

CORRIGAN, IVES & CO.,
DEALERS IN
Iron Ore & Pig Iron,
Rooms 716. 717. 718, 719 Perry-Payne Bld'g.
CLEVELAND, O.

OGLEBAY, NORTON & CO.,
Successors to Tuttle, Ogiebay & Co.,
Commission Dealers in
Iron - Ores,
FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,
CLEVELAND, OHIO.

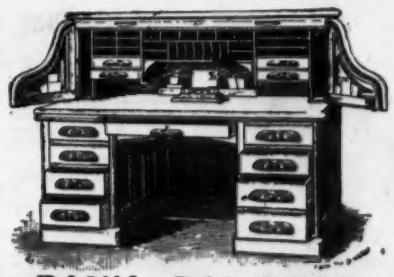
J. H. OUTHWAITE. W. G. POLLOCK.
J. H. OUTHWAITE & CO.,
Exclusive attention given to
LAKE SUPERIOR AND MENOMINEE RANGE
Iron Ore,
Perry-Payne B'ld'g. Cleveland, O.

THE CONDIT-FULLER CO.,
Pig and Bar Iron,
CLEVELAND. OHIO.

E. C. POPE,
COMMISSION DEALER IN
Iron Ore, Pig Iron
AND METALS.
Cleveland, - Ohio.

Sam'l. L. Matnet, Prest. & Treas. Fred. A. Morse, Sec'y.
Cleveland Iron Mining Co.,
Dealers in Iron Ores
from their own mines near Marquette, Lake Superior.
Rooms 4 & 5 Mercantile Bank Building,
CLEVELAND O.

THE NEW PHILADELPHIA IRON AND STEEL CO.
MANUFACTURERS OF
SHEET IRON AND SHEET STEEL
FOR Roofing, Galvanizing AND ALL OTHER PURPOSES.
N.P.I.&S.CO.
N.P.
REFINED
TRADE MARK
OFFICE AND WORKS
NEW PHILADELPHIA, OHIO.

DESKS.

BANK, RAILROAD
—AND—
OFFICE + FURNITURE.
Interior Work a Specialty.
Send for Illustrated Catalogue.
THE CLEVELAND DESK CO.
97-99 Ontario St., Cleveland, Ohio.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb @12
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.... dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single.....dis 40
Shults Raw Hide Leather Belting, double, and Light Double.....dis 40
Standard, oak tanned.....dis 50&10
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 12

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 65

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1¾".....dis 50&10
Morse Taper and Straight shank Larger than 1¾".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
¼ kegs ₩ lb	4½c	5½c		2½c
⅛ kegs ₩ lb	4½c	5½c		3 c
6 lb cans, 10 in case	6 c	6½c		5 c
6 lb cans, less than 1	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&10

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Nicholson's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
Industry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	⅜	7-16	½	⅝	¾	⅞	1
Square	8	7	5⅝	4½	4	2⅝	2⅜
Hexagon	13½	11½	8⅝	6	5⅛	5⅛	5
Washers	9	8	7	5	4⅜	4⅜	4⅜

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $5.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¾ inch and over.....₩ lb 15¾
Sisal, ¾ inch and over.....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@10
" Band.....dis 20
" Scroll.....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 30
Atkins' Cicular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 25c per pair
No. 6 " .....dis 15c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—New List 1890.

Flat head iron.....dis 72½
Round head iron.....dis 67½
Flat head brass.....dis 72½
Round head brass.....dis 65
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.	BC.	B.
No. 12, Flax Twine, ¼ and ⅜ lb Balls		...21C@29C
No. 18 " " ¼ and ½ "		...18C@28C
No. 36 " " ¼ and ½ "		...16C@27C
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine)		11½c
3-Ply ¼ lb Balls		12@12½c
3-Ply " 1½ lb Balls		11@11½c
Cotton Wrapping, 5 Balls to lb		15@16c

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 35

Wire.

New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire, regular.....$6.00@lb dis 1

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 35&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis
William's " " .....dis
Alligator " " .....dis

BLANK BOOKS

Ruled to any pattern.

Best material and workmanship.

CLEVELAND P'T'G & PUB. CO.,

Cleveland. Ohio.

☞PLEASE SEND FOR ESTIMATES.

AMERICAN BRIDGE AND IRON CO.,

Roanoke, - - Va.,

Designers and Builders of

IRON AND STEEL BRIDGES AND VIADUCTS FOR HIGHWAYS AND RAILROADS,

Iron Furnace Plants, Stand Pipes, Mine Car Irons and Wheels,

Also Machinists and Founders. ENGINEERS: C. C. Wentworth and Jos. L. Hunter.

THE STERLING CRATE-BAR COMPANY,

—MANUFACTURERS OF—

The Celebrated Sterling Grate-Bar.

The most economical, the most durable and the easiest of management. Made of cast iron or annealed cast steel, either stationary or with shaking attachment. Prices quoted on all kinds of bars. General offices,

SOCIETY FOR SAVINGS BUILDING, - - CLEVELAND, O.

THE THOS. D. WEST FOUNDRY, CO.

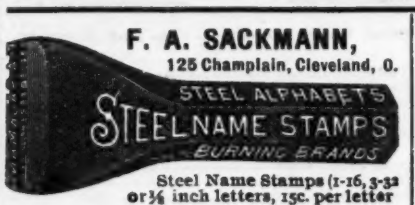
CLEVELAND, O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS—SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY



F. A. SACKMANN,

125 Champlain, Cleveland, O.

Steel Name Stamps (1-16, 3-32 or ¼ inch letters, 15c. per letter

Eastlake Metallic Shingles.

Unequaled for

ROOFING AND SIDING.

Manufactured by

W.J. BURTON & CO.'s

Galvanized Iron Cornice Works,

Detroit, Mich.

Send for illustrated catalogue and prices.

Mention this paper.

UNION ELECTROTYPE FOUNDRY

TELEPHONE 2129

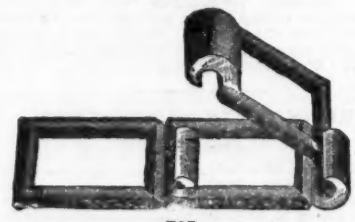
829 SHERIFF ST. CLEVELAND O

JEFFREY

Link Belting

—ALSO—

MALLEABLE, STEEL, WROUGHT AND SPECIAL CHAINS



FOR

Elevating and Conveying Machinery.

Send for catalogue and

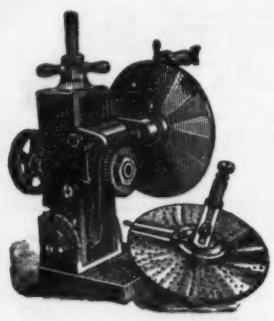
REDUCED PRICE LIST.

THE JEFFREY MFG. CO.,

143 E. First Ave., Columbus, O.

Chicago Branch, - - 48 So. Canal St.

New York Branch, 15 Cortlandt St.



Palmer's Gear Cutting Attachment

CAN BE USED ON ANY SCREW-CUTTING LATHE FOR

Amateurs, Clock Makers, Model Makers, Knitting Machine Makers, Tool Makers,

Or any one having use for SMALL GEARING.

For particulars, address

PALMER, CUNNINGHAM & CO., L't'd,

607 Market St., PHILADELPHIA, PA.

GRANULATED RAW BONE

For Case Hardening and Coloring

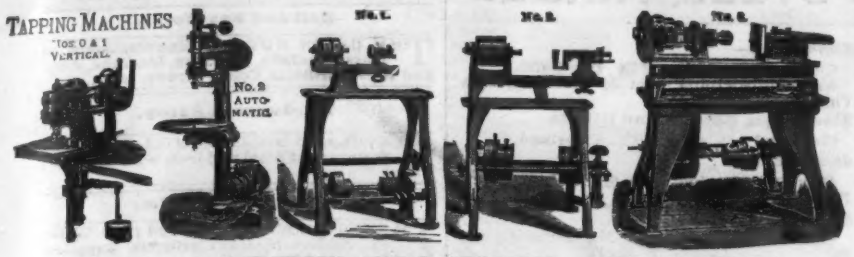
For samples, prices, etc., apply to

THE ROGERS & HUBBARD CO., Middletown, Ct.

PATENTS

For INVENTORS. 40-page Book Free. Address W.T. Fitzgerald, Att'y at Law, Washington, D.C.

OUR LINE OF TAPPING MACHINES.



THE GARVIN MACHINE COMPANY,

Manufacturers of, and Dealers in, all kinds of

MACHINERY AND MACHINE TOOLS.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,

Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.

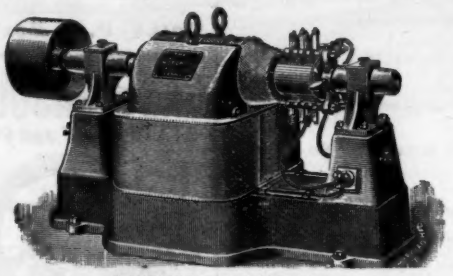
Plants for Manufacturers of Sewing Machines & Electrical Goods.

GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.

Laight & Canal Sts. [Catalogue sent on Application.] NEW YORK.

GILLETTE & LEWIS,

Electrical Contractors & Engineers



SELLING AGENTS FOR

Connecticut Motors and Generators.

Electric Elevators, Isolated Electric Light and Power Plants. All kinds of Electrical Engineering work, Testing, Drafting and Inspecting.

Manufacturers of the LITTLE WONDER BATTERY.

No. 9 Rockwell St., (In rear) CLEVELAND, OHIO.

Edison General Electric Co.

Dynamos and Motors for Steamships, War Vessels, Etc.

Complete Incandescent and Arc Light plants for Iron Working Establishments.

Motors for operating Traveling Cranes, Etc., Etc.

DISTRICT OFFICES.

CANADIAN,	Edison Building, 77 Bay Street, Toronto, Can.
CENTRAL	173 and 175 Adams Street, Chicago, Ill.
EASTERN,	Edison Building, Broad Street, New York.
NEW ENGLAND,	25 Otis Street, Boston, Mass.
PACIFIC COAST,	Edison Building, 112 Bush St., San Francisco, Cal.
PACIFIC NORTHWEST,	Fleischner Building, Portland, Oregon.
ROCKY MOUNTAIN,	Masonic Building, Denver, Colorado.
MEXICAN AND SOUTH AMERICAN DEPT.	Edison Building, Broad St., New York.
EUROPEAN OFFICE,	34 Victoria St., Westminster, London, S. W. Eng.

DIXON'S GRAPHITE PAINT

THOSE who use it say that one pound will cover 2 to 3 times more surface and last 4 to 5 times longer than any lead, mineral or metallic paint. A tin or iron roof well painted will not require repainting for 10 to 15 years

JOS. DIXON CRUCIBLE CO.,
Jersey City, N. J

WHEN YOU WANT

Moulding Sand, Fire Sand, Fire Clay, Bristle Brushes, Steel Wire Brushes, Moulders' Bellows, Riddles, Shovels, Foundry Facings, etc., send to

THE J. DOWNERD & SON CO., Zanesville, O.

☞ We can furnish you best quality goods at lower prices than you can get elsewhere. Try us.

FREIGHT AND PASSENGER

ELEVATORS.

L. S. GRAVES & SON,

Main Office and Works, ROCHESTER, N. Y.

BRANCH OFFICES:

NEW YORK, 9 and 94 Liberty St., BOSTON, 113 Devonshire St.; St. LOUIS, 301 Roe Building

DETROIT, Hodges Building.

SEND FOR CATALOGUE.

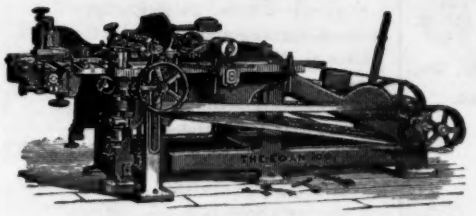
OFFICE. 510---265 to 269 DEARBORN ST.
WORKS AT SOUTH CHICAGO.

THE ECAN CO.,

Nos. 251 to 271 W. Front St., CINCINNATI, OHIO.

Builders and Originators, Designers and Constructors.

Wood-Working Machinery.



New "Standard Molder, Four Sided.

4, 6, 7, 8, 9, 10 and 12-inch.
Geared feed rolls, two above and two in table. Slotted steel heads.

For Every Purpose
Meeting the requirements of
PLANING MILLS,
SASH, DOOR and BLIND FACTORIES
PATTERN SHOPS,
General Wood-workers etc.

With the latest and most advanced type of machines for fast and perfect work.

Catalogue and information-

JOHN ADT & SON,

NEW HAVEN, CONN.

Builders of Machinery for Hardware Manufacture.

AUTOMATIC

Wire Straightening and Cutting Machines,

BUTT MILLING MACHINERY,
Butt Drilling Machinery,
Riveting Machines.
Foot Presses,
Screw Cutters, Etc.

SPICER MANUFACTURING CO.,

New Philadelphia, O.

General Foundry and Machine Work,

Heavy and Light Castings.

Privilege to make estimates solicited.

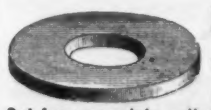


Plate Iron Washers

A SPECIALTY!

Even in Gauge, smooth and well finished.

Cut from new plate, rolled expressly for the purpose. ☞ Write for prices, Address,

MILTON MFG. CO., Milton, Pa.

FOR SALE.

Manufacturing Site

ON CANAL ST., CLEVELAND,

Adjoining White Sewing Machine Co.'s Plant. About 67 ft front extending back to Valley R. R. tracks. For particulars address

B. M. GARDNER,

CARE IRON TRADE REVIEW

Advertising.

IF you wish to advertise anything anywhere at any time write to GEO. P ROWELL & CO., No. 10 Spruce St., New York.

EVERY one in need of information on the subject of advertising will do well to obtain a copy of "Book for Advertisers," 368 pages, price one dollar. Mailed, postage paid, on receipt of price. Contains a careful compilation from the American Newspaper Directory of all the best papers and class journals; gives the circulation rating of every one, and a good deal of information about rates and other matters pertaining to the business of advertising. Address ROWELL'S ADVERTISING BUREAU, 10 Spruce St., N. Y.

BUYERS' DIRECTORY OF IRON AND STEEL TRADES.

Automatic Sprinklers—
Neracher Sprinkler Co., Warren, O.

Advertising Agencies—
G. P. Rowell, New York.

Barbed Wire Fence—
Cincinnati Barbed Wire Fence Co., Cincinnati, O.

Bolts and Bolt Machinery—
Upson Nut Co., Cleveland.

Boilers and Boiler Attachments—
Babcock & Wilcox Co., New York.
Wm. B. Pollock & Co., Youngstown, O.
E. H. Jones & Co., Cleveland.
The Stirling Co., Barberton, O.
Chandler & Taylor Co., Indianapolis, Ind.
Skinner Engine Co., Erie, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Leffel & Co., Springfield, O.
Chas. Miller, Beaver Falls, Pa.

Blowers—
E. H. Jones & Co., Cleveland.

Blowing Engines—
The James Leffel & Co., Springfield, O.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Bridges—
American Bridge & Iron Co., Roanoke, Va.

Coal and Coke—
Pittsburgh & Wheeling Coal Co., Cleveland.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Jhain Belting—
Jeffrey Mfg. Co., Columbus O.

Cupolas—
Victor Colliau, Detroit, Mich.
Unger & Wigham, Chicaeo, Ill.

Chucks—
The Pratt Chuck Co., Clayville, N. Y.

Drilling Machines—
Universal Radial Drill Co., Cincinnati, O.

Drop Presses—
Toledo Tool & Machine Co., Toledo, O.

Desks—
Cleveland Desk Co., Cleveland.

Elevators—
L. S. Graves & Co., Rochester, N. Y.

Explosives—
Hercules Powder Co., Cleveland.

Electrical Manufactures—
Edison General Electrical Co., N. Y.
Gillette & Lewis, Cleveland.
Barr Electric Mfg. Co., New York.

Emery Wheel Machinery—
L. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.

Emery and Corundum Wheels—
Michigan Emery Wheel Co., Detroit, Mich.

Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland.
Union Electrotype Foundry, Cleveland.

Engines (Steam)
Wm Tod & Co., Youngstown, O.
E. H. Jones & Co., Cleveland,
Buckeye Engine Co., Salem, O.
Skinner Engine Co., Erie, Pa.
Westinghouse Machine Co., Pittsburgh.
Southwark Foundry & Machine Co, Philadelphia, Pa.
Totten & Hogg, Pittsburgh, Pa.
James Leffel & Co., Springfield, O.

Engines (Gas)—
Schleicher, Schumm & Co., Philadelphia, Pa. and Chicago, Ill.
Van Dusen Gas Engine Co., Cincinnati, O.

Engineers and Contractors—
E. H. Jones & Co., Cleveland.
Gillette & Lewis, Cleveland.

Ejectors—
James Jenks, Detroit, Mich.

Engineers' Specialties—
Butman Furnace Co., Chicago, Ill.

Files, Makers of—
Reynolds Bros., Columbus, O.
A. & H. Gough, Cleveland.
Parkin & Bosworth Co., Cleveland.
E. K. Morris & Co., Cincinnati, O.

Forges—
Cleveland City Forge & Iron Co., Cleveland.

Foundries—
Thos. D. West. Foundry Co., Cleveland.
Canton Iron Foundry Co., Canton, O.
Spicer Mfg. Co., New Philadelphia, O.
Harn, Ow, & Co., Beaver Falls, Pa.
American Bridge & Iron Co., Roanoke, Va.

Flue Cleaners—
Butman Furnace Co., Chicago, Ill.

Fire Brick Clay—
F. B. Stevens, Detroit, Mich.

Foundry Supplies—
F. B. Stevens, Detroit, Mich.

Gear Cutters—
Palmer, Cunningham & Co., Philadelphia, Pa.

Galvanizers.
H. H. Hodell, Cleveland.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City.

Granulated Raw Bone—
The Rogers & Hubbard Co., Middletown.

Grindstones—
E. K. Morris & Co., Cincinnati, O.

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O.
E. H. Jones & Co., Cleveland.

Hammers (Power)—
Hackney Hammer Co., Cleveland.

Harness Specialties—
Buffalo Specialty Co., Buffalo, N. Y.

Heavy Hardware—
E. K. Morris & Co., Cincinnati, O.

Insurance Companies—
Hartford Steam Boiler Co., Hartford, Ct.

Investments—
Alfred W. Ladd, New York.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Cambridge Iron Roofing Co., Cambridge, O.
Garry Iron Roofing Co., Cleveland.
Berger Mfg. Co., Canton, O.
Eberts Bros., Detroit, Mich.
Kanneberg Roofing Co., Canton, O.
W. J. Burton & Co., Detroit, Mich.
New Philadelphia Iron & Steel Co., New Philadelphia, O.

Iron Ore, Bar and Pig Iron—
Oglebay, Norton & Co., Cleveland.
J. H. Outhwaite & Co., Cleveland.
Condit-Fuller Co., Cleveland, O.
E. C. Pope, Cleveland.
Cleveland Iron Mining Co., Cleveland.
Corrigan, Ives & Co., Cleveland.

Injectors—
Penberthy Injector Co., Detroit, Mich.
Garfield Injector Co., Wadsworth, O.

Lathes—
H. L. Shepard, Cincinnati, O.
Parkin & Bosworth Co., Cleveland.

Lathe Dogs—
Palmer, Cunningham & Co., Philadelphia.

Lathe Tools—
Armstrong Bros., Chicago, Ill.

Link Belting—
The Jeffery Mfg. Co., Columbus, O.

Mining Machinery—
Copeland & Bacon, New York.
American Bridge & Iron Co., Roanoke, Va.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Spicer Mfg. Co., New Philadelphia, O.
Harn, Ow, & Co., Beaver Falls, Pa.
American Bridge & Iron Co., Roanoke, Va.

Machinists' Tools and Supplies—
Parkin & Bosworth, Co., Cleveland.
Garvin Machine Co., New York.
Armstrong Bros., Chicago, Ill.

Metal Ceilings—
Fred F. Bischoff, Chicago, Ill.

Merchandise Brokers—
L. H. Oldfield, Wichita, Kan.

Metallic Shingles—
W. J. Burton & Co., Detroit, Mich.

Manufacturing Sites—
Chas. G. Eddy. Roanoke, Va.

Moulding Sand—
F. B. Stevens, Detroit, Mich.

Motors and Dynamos—
Edison General Electrical Co., New York.
Gillet & Lewis, Cleveland.

Natural Gas Specialties—
A. Harvey's Sons Mfg. Co., Detroit, Mich.

Patents—
Munn & Co., New York.
W. T. Fitzgearld, Washington, D. C.
Thos. P. Simpson, Washington, D. C.

Pumps (Steam)—
E. H. Jones & Co., Cleveland.
Deming Co., Salem, O.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago Ill
Aitchison Perforated Metal Co., Chicago.

Power Hammer—
Hackney Hammer Co., Cleveland.

Powder Mining Machinery—
Hercules Powder Co., Cleveland.

Photo Engravings—
Union Photo Engraving Co., Cleveland.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Rock Breakers and Ore Crushers—
Totten & Hogg, Pittsburgh, Pa.

Rolls and Pinions—
Totten & Hogg Iron & Steel Foundry Co., Pittsburgh, Pa.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Saws—
Peter Gerlach & Co., Cleveland.

Search Lights for Vessels—
Edison General Electrical Co., New York.

Second Hand Machinery—
Parkin & Bosworth Co., Cleveland.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.
F. A. Sackman Cleveland, O.

Sheet Iron—
Cleveland Rolling Mill Co Cleveland.
New Philadelphia Iron & Steel Co., New Philadelphia, O.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.

Sheet Steel—
New Philadelphia Iron & Steel Co., New Philadelphia, O.

Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa

Steam, Gas and Plumbers Supplies—
A. Harvey's Sons Mfg. Co., Detroit, Mich.

Twist Drills—
Cleveland Twist Drill Co., Cleveland.
Graham Twist Drill Co., Detroit, Mich.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Typewriters—
Wyckoff, Seaman & Benedict, Cleveland.

Ventilating Fans—
E. H. Jones & Co., Cleveland.

Water Gas Furnaces—
W. S. Hutchinson, Chicago, Ill.

Window Blinds—
Hartman Sliding Blind Co., Wooster, O.

Wire Goods—
Cincinnati Barbed Wire Fence Co., Cincinnati, O.

Wood-Working Machinery—
Frank & Co., Buffalo, N.Y.
The Egan Co., Cincinnati, O.

Wire Machinery—
John Adt & Son, New Haven, Conn.

Wire Nails—
Cincinnati Barbed Wire Fence Co., Cincinnati, O.

Washers—
Milton Mfg. Co., Milton, Pa.

For Sale.

ALL or part of well established machine shop and foundry, owning gas well, in a growing gas city. Address A. G., care IRON TRADE REVIEW.

WANTED.

POSITION as foreman of machine shop or tool maker, by sober man, eight years' experience as foreman on engine, pipe threading machinery and general work. Can make drawings. Terms reasonable if a steady job guaranteed. Address Box 25, care IRON TRADE REVIEW.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus st.
Factories on Columbus, Winter and Leonard streets.

Cleveland, O., U. S. A.

PATENTS THOS. SIMPSON, Washington D.C. No atty's fee until Patent obtained. Write for Inventer's Guide.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President
B. PIERCE, Secretary and Treasurer.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

A S. FERRY, Gen'l Agt., 208 Superior Street, Cleveland, O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland, O.
R. D. BRIGGS, Special Agt., 208 Superior St, Cleveland, O.
J. R. WOLCOTT Special Agent, 208 Superior St., Cleveland, O.
L. C. BURWELL, Special Agent, 81 4th A Pittsburgh, Pa.

CLEVELAND BUSINESS DIRECTORY.

Bolt and Nut Works.

THE UPSON NUT CO, Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Hardware and Iron.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire.

Machinists' Supplies.

PARKIN & BOSWORTH, 9 and 11 So. Water St., dealers in Manufacturers' Supplies, Machinery and Tools.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

BUSINESS DIRECTORY.

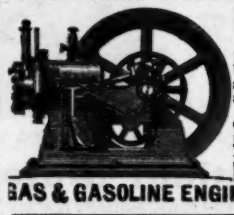
CHEMIST—A chemist wants position in iron or steel works, or at ore mines. Address L. P. N., Iron Trade Review.

A First-Class Importer of
PORTABLE RAILWAYS
—AND—
ROLLING STOCK

To the West Indies and South America is desirous to enter in relations with United States manufacturers of rails, cars, locomotives, etc. Address,
RAILS, P. O. Box 672, New York.

GAS and GASOLINE ENGINES

STATIONARY and PORTABLE. All Sizes.



Dwarfs in Size, but Giants in Strength.
Expense one cent an hour per horse power and requires but little attention to run them. **Every Engine Guaranteed.** Full particulars free by mail Mention this paper.
VAN DUZEN GAS & GASOLINE ENGINE CO. Cincinnati, O.

Bischoff Metal Ceilings,

(PATENTED.)

It will pay to investigate and write for catalogue.

Estimates submitted on application.

Fred. F. Bischoff & Co.
24 W. Lake St,
CHICAGO, - ILL.

ECLIPSE ELECTROTYPE ENGRAVING CO. AUST & CLARK PROPRIETORS

L. H. OLDFIELD.

Merchandise Broker.

Correspondence Solicited.

WICHITA, KANSAS.

Tens of thousands of these blinds are in use. Agents wanted; Send 4-cent stamp for an 80-page illustrated catalogue to

HARTMAN SLIDING BLIND CO.,
59 Beaver St. WOOSTER O., U. S. A

BARR ELECTRIC MANUFACTURING CO.,

Incorporated under the Laws of the State of New York.

17 and 19 Broadway, New York.

This illustration represents our Electric Lighter. It is complete in itself—requires no extra Power Works or Connections. The current of electricity is generated by chemical action. It occupies the space of but Six Square inches. The construction is simple in the extreme. It can be taken to pieces at will, and just as easily readjusted. **A child can operate it.** Simply by pressing the centre rod the current of electricity is generated, and the light is instantaneous.

ECONOMY.—The material to charge the Battery can be obtained at any drug store at a cost of Ten Cents, and will run 30 to 60 days. Any part can be replaced at a cost not exceeding Ten Cents. Aside from its use as a lighter this apparatus does away with the use of matches and the dangerous results and disagreeable odors arising from same. We have taken especial care in the manufacture of these Electric Lightning Batteries. They are handsomely constructed in nickel plate and highly ornamental, and will take a prominent place among the bric-a-brac of reception rooms, parlors etc. Full directions accompany each apparatus. Aside from lightning purposes, the battery of our apparatus can be used for Motor Fan, Medical, Call Bell or Burglar Alarm purposes, all of which attachments we supply. Goods shipped C. O. D. on receipt of Twenty per cent.

LIBERAL DISCOUNTS TO TRADE AND AGENTS.

We desire reliable representatives in every State in the Union, and invite correspondence on the subject.

For Sale for Cash, or Credit on Car Trust.

20 Second-Hand Standard Passenger Coaches.
30 New Standard Gauge Passenger Coaches, built at one of the best works in the United States. All modern improvements. Price, $3,700 each. Now ready to letter.
40 Second-Hand Narrow Gauge Locomotives, different sizes.
Second-Hand Standard Gauge Locomotives, different sizes.
Second-Hand Box Cars, 20 tons capacity; liberal terms.
These Locomotives have been overhauled, all in good condition, ready for immediate delivery.

1,000 tons of 40-lb. second-hand steel and iron rails.
800 tons of 35-lb iron and steel rails, second hand.
1,300 tons of 40-lb. iron and steel rails. All these rails are in good order.
Also 9 Sleeping Cars suitable for theatrical purposes, second-hand. 70 Box Cars and 70 Coal Cars, 20 tons capacity each, second-hand.
Southern and Western Delivery.

Agent for Wm. B Pollock & Co.'s Oil Tank Cars, for sale at lowest possible prices. Photos and specifications sent with prices if desired. Bonds negotiated on new and old roads. Long roads preferred.

Apply to ALFRED W. LADD,

44 Broadway, NEW YORK.

Estimates furnished for Electrical Equipment under Latest Improvements.

AGENTS: { J. H. FALL & CO., Nashville Tenn.
THOS. P. ALSTON, Esq., 62 East Alabama St., Atlanta, Ga.
G. D. BUSTEMANTE, Birmingham, Ala.

—THE—

Birmingham & Jones Valley R.R. Company,

OF BIRMINGHAM, ALABAMA,

Offers for sale at 85 per cent. one Million of their first mortgage 6 per cent Bonds, which is only $15,000 per mile, making it a safe, paying investment.

For information call on or address,

ALFRED W. LADD, Sole Agent,

44 Broadway, NEW YORK.

A New Coal Field and Timber District.

The OHIO EXTENSION of the NORFOLK & WESTERN RAILROAD penetrates one of the most valuable coal and timber districts in the United States. The line of this extension is 193 miles in length, from Coal Grove, Ohio, via Kenova, W. Va., to Elkhorn, W. Va., of which 54 miles, to Dunlow, W. Va., is now opened for business and the entire line is under construction and will be completed early in the fall of 1892. It passes through virgin country abounding in gas, splint, cannel, steam, coking and domestic coals and fire-clay, chestnut-oak, white oak, beech and poplar timber. Those looking for advantageous sites for the location of saw-mills or tanneries and establishments for the manufacture of furniture, wagons, agricultural implements, wood-pulp, fire-brick, or manufactured iron articles, should investigate the resources of this new field. The new town of Kenova, W. Va., offers many advantages for the location of manufacturing establishments, also the territory opened up by the Norfolk & Western Railroad on the north bank of the Ohio River, between Kenova, W. Va. and Portsmouth, O. For the manufacture of finished iron articles the district offers unequalled advantages, with supply of coal and Pocahontas coke on short hauls, and with the blast furnaces of the Ironton, Hanging Rock and Ashland district in close proximity. Favorable freight rates made upon raw material to all manufacturing establishments on this line.

For further information as to freight rates, maps, names of parties to whom application should be made for coal leases, etc., apply to

JOHN J. ARCHER, or CHAS. G. EDDY,

Div. Frt. Agt., COLUMBUS, OHIO. — Vice-Prest., ROANOKE, VA.

FOR
ARTISTIC
PRINTING
WRITE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND O.

MICHIGAN

EMERY WHEEL CO.

194 Catherine St., Detroit, Mich.

Solid Emery & Corundum Wheels, to Run Wet or Dry, Special Shapes.

Perfection Saw Gummers.

SEND FOR PRICE LIST.

SHEPARD'S NEW $60

SCREW CUTTING

Foot Lathe

Cap Lathes, $1.25

Foot & Power Lathes, Drill Presses, Scroll Saw Attachm'ts, Mandrels, Chucks, Twist Drills, Dogs, Calipers, etc. Lathes on trial. Lathes on payment. Send for catalogue of Outfits for Amateurs or Artisans. Address H L. SHEPARD, Agt., 124 East Second St., Cincinnati, O.

From Cleveland Union Station,

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	d5 25 a m	7 45 a m
	d11 40 a m	d1 40 p m
	6 35 p m	d11 10 p m
Wellsville, Wheeling and Bellaire.	12 30 p m	7 45 a m
	6 35 p m	1 05 p m
	.....	*11 10 p m
Alliance Accom.	10 10 a m	3 25 p m
Ravenna Accom.	8 25 a m	5 00 p m

d Daily. * Except Saturday. Other trains except Sunday. Through Pullman Sleepers to New York on 1:40 p. m. train daily.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Arrive.	Depart.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	d 7 00 a m	d 8 00 a m
	d 5 40 p m	d 8 00 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	12 30 p m	1 05 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	d 5 40 p m	d 8 00 a m
	10 10 a m	3 25 p m

d Daily. Other trains except Sunday.

Pullman Palace Sleeping Cars daily between Cleveland, Columbus and Cincinnati City ticket office, Weddell House corner.

Wheeling & Lake Erie Railway.

THE NEW THROUGH LINE
BETWEEN
TOLEDO
—AND—
Steubenville, Pittsburgh, Marietta.

THROUGH COACHES
BETWEEN
Toledo & Marietta.

Through Sleepers Between
PITTSBURGH AND CHICAGO.
AND DAY COACHES BETWEEN
Toledo and Pittsburgh, Via Akron, Cuyahoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.

The Only Line running through
"BEAUTIFUL ZOAR."

A. G. BLAIR, Traffic Manager. — JAS. M. HALL, Gen'l Pass. Agent

DON'T USE poor printing when you can get the best at the same prices, of the CLEVELAND PRINTING & PUBLISHING CO., Cleveland, O.

ERIE LINES

THE FAVORITE
—AND—
PICTURESQUE ROUTE
—TO—
New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the South east.

New Central Depot So. Water St. and Viaduct

	Depart.
No. 62, Accommodation	† 6 00 a m
No. 72, New York & Pitts. Express	* 8 15 a m
No. 70, Pittsburgh Accom	*11 25 a m
No. 64, New York & Pitts. Limited	* 3 00 p m
No. 66, Mantua Accommo	* 4 20 p m
No. 74, Youngst'n Ex	† 6 00 p m
No. 68, New York & Pitts. Ex	*11 00 p m
	Arrive.
No. 71, N. Y. & Pittsburgh Express	* 7 00 a m
No. 65, New York & Pitts. Lim	* 9 55 a m
No. 67, Pittsburgh Accom	*12 20 p m
No. 73, Leavittsburgh Local	2 10 p m
No. 63, New York & Pitts. Ex	* 6 50 p m
No. 75, Mantua Accom	* 7 20 p m
No. 69, Youngstown Express	† 9 10 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.
A. M. TUCKER, Gen. Mang., Cleveland, O.
D. I ROBERTS, Gen. Pass. Ag't, New York
G. K. FOUTS, G P. & T. A., Cleveland.

PITTSBURGH AND LAKE ERIE RAILROAD.

"Cleveland & Pittsburgh Short Line."

Twenty (20) Miles Shorter than any other route between Cleveland, Pittsburgh, Washington, Baltimore and the South East.

5 Through Trains Daily 5

FAST TIME. NO DELAYS.

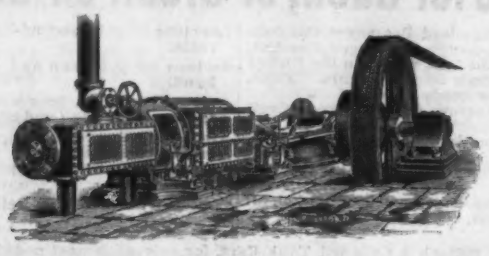
"For scenery picturesque and varied,
Through valleys green, 'mong mountains ser-
The people's favorite route I ween, [ried,
The P. & L. E. sits enthroned as queen."

See that your tickets read via

THE PEOPLE'S FAVORITE ROUTE.

E. HOLBROOK, Gen'l Supt. — A. K. CLARK, G. P. & T. A.
Pittsburgh, Pa.

WILLIAM TOD & CO., YOUNGSTOWN, OHIO.



The Porter Hamilton Engine.

Single Compound and Condensing-100 horse-power and upwards.

THE HAMILTON BLOWING ENGINE, HYDRAULIC CRANES, ACCCUMULATORS AND SHEARS.

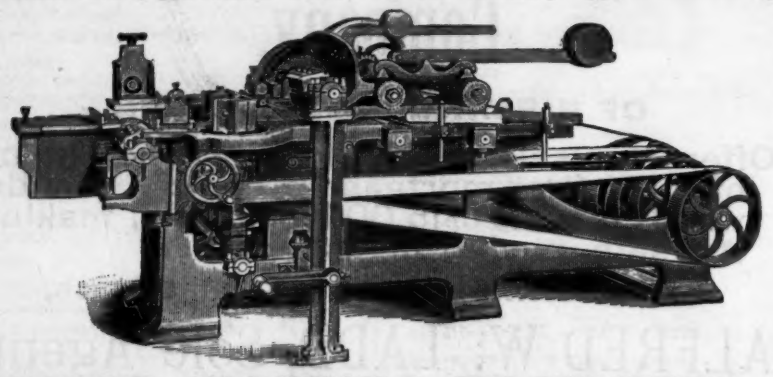
HEAVY SPECIAL MACHINERY GENERALLY.

☞ SEND FOR ILLUSTRATED CATALOGUE.

FRANK & CO., BUFFALO, N. Y.

MANUFACTURERS OF

PLANERS, MOULDERS, TENONERS MORTISERS
BAND SAWS, SCROLL SAWS, SAW TABLES, BENCHES.



WOOD WORKING MACHINERY.

E. H. JONES & CO.,

ENGINEERS AND CONTRACTORS,

223-225 River St., CLEVELAND, O.

Steam Plants Complete. Engines, Boilers, Pumps, Heaters, Etc.
Steam and Hot Water Heating.

STURTEVANT'S BLOWERS, COILS, ETC.,
FOR HOT BLAST HEATING.

THE DEMING CO.,

SALEM, OHIO.

Pumps,

For HAND AND POWER.

Adapted for BOILER FEEDING, FIRE PURPOSES, etc.; also ARTESIAN WELL CYLINDERS and WORKING HEADS for FACTORIES, MILLS and FURNACES.

HENION & HUBBELL, 55 & 57 N. Clinton St., Chicago, General Western Agents

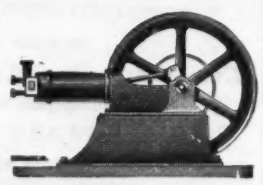
Send for illustrated catalogue and price list. Mention this paper.

Otto Gas Engine Works,

SCHLEICHER, SCHUMM & CO., { Philadelphia. Chicago.

Horizontal OTTO Gas Engines.
Vertical OTTO Gas Engines.
Twin Cylinder OTTO Gas Engines.
Combined OTTO Gas Engine Pumps.
Combined OTTO Gas Engine Dynamos.

SIZES: 1, 2, 4, 7, 10, 15, 25 AND 50 HORSE-POWER.



Rapid Harness Menders.

Strong and simple. Easily applied. A common hammer does the work. Just drive them in and clinch them.

Sell like hot cakes. They are packedi n neat counter cases and can be displayed to great advantage. This is not an article for the harness trade, but for hardware merchants. Samples, circulars andfull particulars mailed on application.

BUFFALO SPECIALTY MFG. CO. Buffalo, N. Y., U. S. A.

THE STIRLING COMPANY

MANUFACTURE

The Safest. Most Economical, Compact and Durable High Pressure

WATER TUBE BOILERS.

All Wrought Steel. Large Mud Drum. Perfect Circulation.

By removing four manhole covers access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed.

GENERAL OFFICE: Pullman Bldg., Chicago.
PITTSBURGH OFFICE: Lewis Block.
CLEVELAND OFFICE: Bradley Block.
NEW YORK OFFICE 74 Cortlandt St.

Works: BARBERTON. SUMMIT COUNTY, OHIO.

TYPEWRITERS.

THE REMINGTON
STANDARD TYPEWRITER

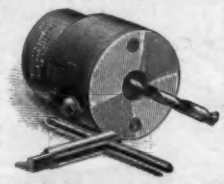
Is to-day, as it has ever been, the leading Typewriter.
Carefully tested improvements are constantly added to this famous machine.

TRY OUR PARAGON BRAND OF TYPEWRITER RIBBONS.

WYCKOFF, SEAMANS AND BENEDICT,
137 Superior St., Cleveland, O.

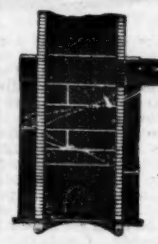
Positive Driving Drill Chuck.

For either straight or taper shank drills.



Has the Holding Power of Taper Socket, together with all the advantages of the common Friction Chuck Write for Illustrated Price List and discounts to the

PRATT CHUCK CO.,
Clayville, N. Y., U. S. A.

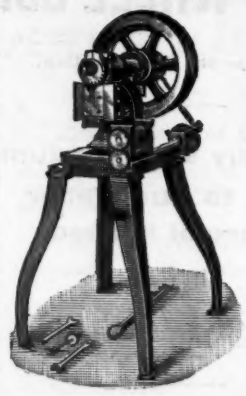


VICTOR COLLIAU,
Sole Manufacturer of the
Improved Patent
HOT BLAST
COLLIAU CUPOLA

ADDRESS:
287 Jefferson Ave.,
DETROIT, - MICH.

BOILERS

MAHONING BOILER WORKS.
PIPES, STACKS, BEAMS, ROOF TRUSSES, BLAST FURNACES ROLLING MILL WORK.
WM. B. POLLOCK & CO. YOUNGSTOWN, O.



THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

PRESSES, DROP PRESSES, DIES,

AND

Special Machinery

DESIGNED AND BUILT TO ORDER.

Dies for all kinds of sheet metal goods, leather, paper, etc. Inventors' models and specialties. Send for circulars and prices.

St. Clair and Washington Streets.

Mention this paper. TOLEDO, O.

HERCULES POWDER

HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

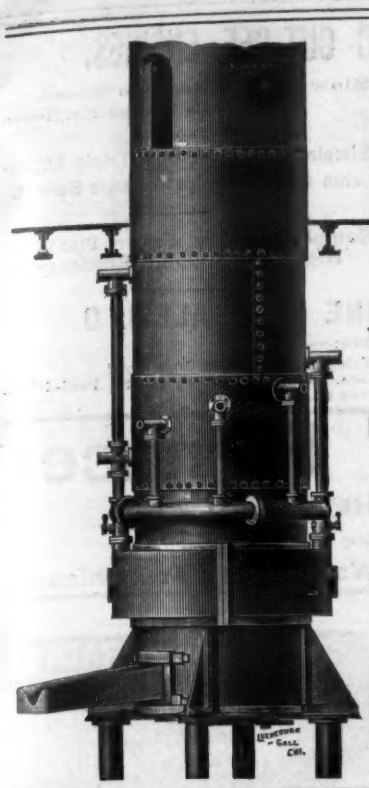
STRONGEST and SAFEST EXPLOSIVE

Known to the Arts.

POWDER, FUSE, CAPS,

Electric Mining Goods,

AND ALL TOOLS FOR STUMP BLASTING.
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
L. W. WILLARD, Manager.



THE
GREINER
Patent Economical
CUPOLA.

15 to 50 Per Cent. Saving in Fuel,
With Corresponding Increase in Quality of Iron Melted, Over any Existing Cupola.

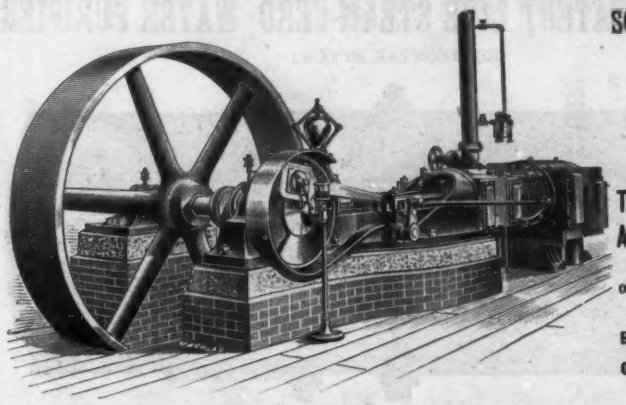
15 Per Cent Saving Guaranteed.

Can be Applied to any Type of Cupola Now in Use.

400 IN USE IN EUROPE.
U. S. REFERENCES GIVEN.

AGENTS WANTED.

UNGER AND WIGHAM,
301 Phenix Building, Chicago.



SOUTHWARK FOUNDRY AND MACHINE CO.,
PHILADELPHIA, PA.

Sole Makers of
THE PORTER-ALLEN AUTOMATIC ENGINE,
Simple, Compound or Triple Expansion.
ALSO BUILDERS OF
Blowing Engines. Reversing Engines, Centrifugal Pumps, Boilers. Tanks, Etc.

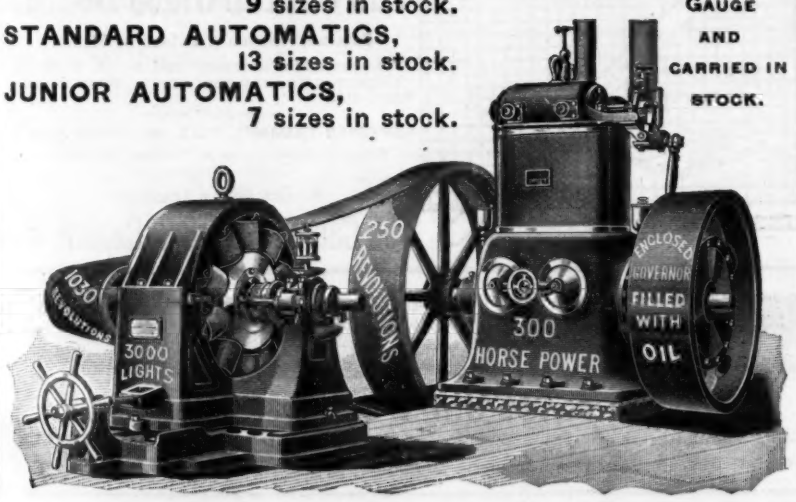
GARRY IRON & STEEL ROOFING COMPANY
CORRUGATED
ROOFING SIDING & CEILING
CLEVELAND OHIO.

CLEVELAND
GALVANIZING WORKS.
H. H. HODELL & CO.,
Galvanizing in all its branches, and Manufacturers of Rubber Buckets for chain pumps.
CLEVELAND, OHIO.

WESTINGHOUSE ENGINES

AUTOMATIC COMPOUND,
9 sizes in stock.
STANDARD AUTOMATICS,
13 sizes in stock.
JUNIOR AUTOMATICS,
7 sizes in stock.

REPAIRS MADE TO GAUGE AND CARRIED IN STOCK.



COMPOUND DRIVING DYNAMO.

THE WESTINGHOUSE MACHINE COMPANY.
PITTSBURGH. PENNA. U.S. OF A.

SKINNER ENGINE CO., ERIE, PA.

OVER 4500 IN USE.
MANUFACTURERS OF
AUTOMATIC, STATIONARY & PORTABLE
ENGINES and BOILERS
SEND FOR CATALOGUE.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and cheapest Paint made.

FURNISHED both Dry and Ground in Oil.

USED BY NEARLY ALL THE RAILROADS

THE KANNEBERG ROOFING CO., Canton, O.
The Originators of Strictly Genuine Steel Roofing.)

MANUFACTURERS OF THE
Kanneberg Pat., Latest Improved, Folded Lock Seam Roofing,
Made of STRICTLY GENUINE STEEL.
CORRUGATED IRON (four sizes of corrugations), and Crimped Edge Iron Roofing and Siding, Beaded Iron Siding and Ceiling, Water Proof Building Paper, Dry and Ready Mixed Paints, Etc
Write for Catalogues, Price Lists and Samples.

FOR SALE---BLOWING ENGINE.

Vertical pattern, with balanced steam slide valve gear, steam cylinder 14-in. diameter, air cylinder 40-in. diameter, stroke 24 in., 1 to 190 strokes per minute; engine new. For price and particulars address **THE JAMES LEFFEL & CO., Springfield, O.**

CAMBRIDGE ROOFING CO., Cambridge, O. & Chatanooga, Tenn.

Manufacturers of
Plain, Rolled, Crimped Edge, Corrugated and Beaded Roofing, Siding and Ceiling
PURE STEEL A SPECIALTY
Send for Descriptive Catalogue

WHAT'S THAT?

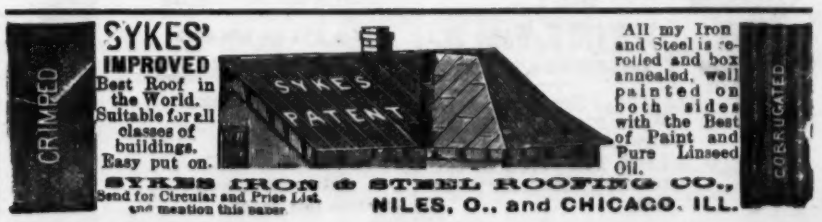
For good quality and bottom prices order your FACINGS, FIRE-BRICK, CLAY,

FOUNDRY SUPPLIES,

MOULDING SAND and everything for a foundry, o.

That's What!

F. B. STEVENS.
DETROIT, MICH.

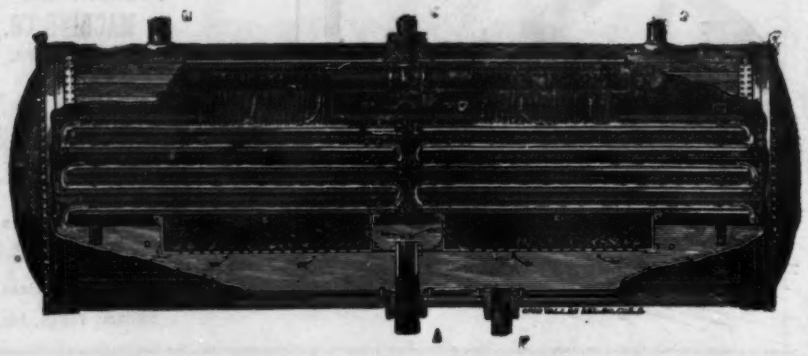

CRIMPED
SYKES' IMPROVED
Best Roof in the World. Suitable for all classes of buildings. Easy put on.
SYKES PATENT
All my Iron and Steel is re-rolled and box annealed, well painted on both sides with the Best of Paint and Pure Linseed Oil.
CORRUGATED

Send for Circular and Price List, and mention this paper

SYKES IRON & STEEL ROOFING CO.,
NILES, O., and CHICAGO, ILL.

STILWELL'S PATENT LIVE STEAM-FEED WATER PURIFIER

(HORIZONTAL STYLE.)



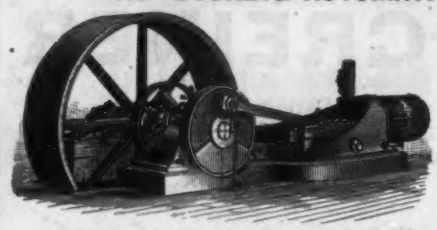
Removes all Impurities. Entirely Prevents Scale in Steam Boilers.

CATALOGUE ON APPLICATION.

STILWELL & BIERCE MANUFACTURING CO.

DAYTON, OHIO.

THE BUCKEYE AUTOMATIC CUT-OFF ENGINES.



Slow Speed, Medium Speed, and High Speed Engines.

Simple, Compound, and Triple Expansion Engines, High Pressure Boilers.

Complete Steam Power Plants of Highest Attainable Efficiency.

Address BUCKEYE ENGINE CO., SALEM, O.

SALES AGENTS:

Buckeye Engine Co., Sales Agency, 10 Telephone Building, New York.
A. A. Hunting, John Hancock Building, Boston, Mass. Robinson & Cary Co., St. Paul, Minn.
N. W. Robinson, 97 Washington St., Chicago, Ill.

Water Gas Furnaces

FOR LOCOMOTIVES, STEAMBOATS AND STATIONARY BOILERS.

A Perfect Smoke Burner.

W. S. HUTCHINSON. 9 Washington-st., Chicago.

OLD 1874. **CLEVELAND TWIST DRILL CO.,** RELIABLE 1892.

SEND FOR CATALOGUE. **Cor. Lake & Kirtland Sts., Cleveland, O.** WRITE FOR DISCOUNTS.

The Hart or Detroit

Emery Corundum Wheels and Machinery.

Write to J. WENDELL COLE, M. E.,

District Manager, Box 152, Chicago, Ill., or Box 84, Columbus, O.

N. B.—Also Agent for WM. SELLERS & CO.'S SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

Penberthy Automatic Injector.

OPINIONS OF THE PENBERTHY INJECTOR.

L. M. RUMSEY MF'G CO., PUMPS, PIPES AND FITTINGS. } ST LOUIS, MO., JUNE 4, '91. }

Penberthy Injector Co., Detroit, Mich.

GENTLEMEN:—It gives us pleasure to inform you that the "Penberthy" is daily growing into popularity among our customers, and we cannot speak too highly in its praise.

Yours truly,
L. M. RUMSEY MF'G CO.

PENBERTHY INJECTOR CO., Manufacturers, Detroit, Mich.

Jobbers of all kinds of **Roofing Materials.**

W. H. EBERTS. ESTABLISHED 1871 J. M. EBERTS.

EBERTS BROS,

MANUFACTURERS OF

CORRUGATED IRON ROOFING, SIDING & CEILING.

OFFICE AND WORKS 192 to 198 HIGH ST. WEST

DETROIT, MICH.

PRESSED STANDING SEAM V Crimped and Roll Cap **IRON ROOFING.**

PRESSED WROUGHT IRON OPEN TURN BUCKLES.

BEST AND Cheapest.

The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with iron for tie rods.

CLEVELAND CITY FORGE & IRON CO., CLEVELAND, OHIO.

REYNOLDS BROS.,

MANUFACTURERS OF

Hand Cut Files

AND RASPS.

We solicit the commercial trade only.

133 & 135 N. Water St.,

COLUMBUS, OHIO.

Old Files Recut and Warranted Superior to any Machine Cut and Lead Tempered in the market. Send for price list.

INDUSTRY FILE WORKS,

A. & H. Gough, Props.

Manufacturers of

Files and Rasps,

Equal to the Best English File.

OLD FILES RE-CUT.

All Kinds of Job Grinding.

OFFICE & WORKS,

48 COLUMBUS ST.,

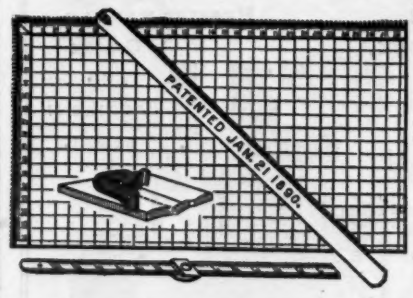
CLEVELAND O.

C. GOUGH Manager.

Mention this paper.

Awarded the GRAND PRIZE at the Paris Exhibition.

Cleveland Office, 412, Perry-Payne Building, Cleveland, O.



The Canton Glass Board.

Cuts any Fraction of an Inch by Eights.

Unequaled for accuracy and quick work in cutting square or at any angle. Saves breakages, etc.

ALSO

IMPROVED TRAMMEL RULE for Cutting Circles From 3 inches up to 48 inches, Segments, Gothic Shapes, etc.

Send for Circular.

The Canton Saw Co., Canton, O.

GRAHAM TWIST DRILL CO. Detroit, Mich.,

Sole manufacturers of GRAHAM'S PATENT GROOVED SHANK TWIST DRILLS and CHUCKS. Endorsed by progressive mechanics everywhere. Send for Catalogue.

NOW THE STAR POWER HACK SAW.

JUSTIFIES all the GOOD WORDS spoken of and for it. We have placed a number of them and have not heard a single complaint. For cutting shafting, etc., it is unequaled. Price $25.

Address your order to

THE PARKIN & BOSWORTH CO., 6 South Water Street, CLEVELAND, OHIO.

STEEL CASTINGS

FROM 1-4 TO 15,000 LBS. WEIGHT.

True to pattern, sound, solid, free from blow-holes and of unequaled strength.

Stronger and more durable than iron forgings in any position, or for any service whatever.

60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel, now running, prove this.

Crossheads, Rockers, Piston-Heads, etc., for Locomotives.

STEEL CASTINGS of every description.

Send for circulars and prices to

CHESTER STEEL CASTINGS CO.,

WORKS: CHESTER, PA. } OFFICE: 407 LIBERTY ST., PHILADELPHIA, PA.